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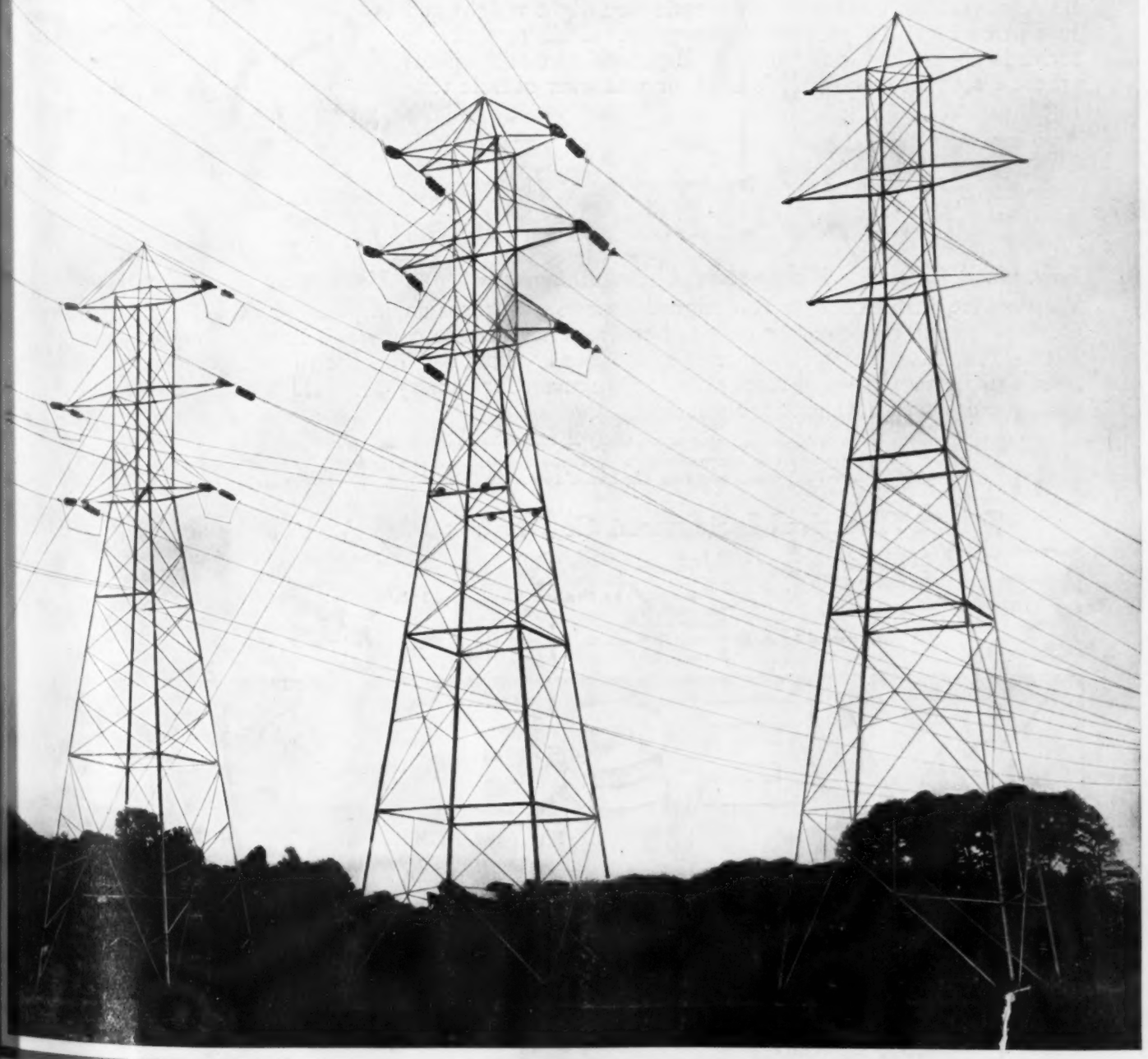

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W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

Volume 81 New York, Saturday, February 3, 1923 Number 5

Farm Power as an Issue

SOMETHING like six and a half million families are engaged in agriculture on the farms of the United States. The farm is a factory as well as a home and the use of power is almost continuous. Practically one-third of the entire population of the country are therefore looking to the day when electric service will be made as available to them for universal use as it has been in the industrial workshops of our cities.

For the farmer knows that adequate electric power will bring to him the greatest contribution to farm efficiency since the introduction of the self-binder. Not even the gasoline tractor can challenge it.

ACCORDING to the United States Census of 1920, there are at present in use on the farms of America 19,767,161 horses, 5,432,391 mules, 246,083 gasoline tractors and 139,169 motor trucks, which represent on a conservative estimate 25,000,000 primary horsepower. In addition, there are 2,146,362 passenger automobiles and a countless number of steam tractors, stationary gas and steam engines, windmills and electric motors. Each of these prime movers, including the automobile, is an essential unit in the farm power plant under present conditions. Therefore, the total primary horsepower engaged in agriculture exceeds the 29,504,792 primary horsepower used in the manufactures of the country by a considerable amount.

Farm-management studies show that the cost of power and machinery represents from 30 to 50 per cent of the present expense of farm operation. Annually from 50 hp.-hr. to 60 hp.-hr. per crop acre is required to produce the crops of this country over the 503,073,007 acres under cultivation. In the neighborhood of one-third of this gigantic load is admirably adapted to the use of electric power. The farmer is impatiently waiting for the expansion of urban electric systems so that they will reach out into the country and assist him with his burden.

WHEN more than one-third of the people of the country are needing and clamoring for an organized public utility service which the other two-thirds are enjoying, the time has passed when the utility man can profitably discuss whether or not the service shall be given. It has become entirely a question of how it can be done. The farm needs power. The farm home also suffers for want of all those comforts which electricity brings and which have become so prominent a feature of the public service which the central station renders. And the entire country is affected by these conditions. Therefore the problem is to find as speedily as may be the way to carry central-station service to the farm on a basis profitable both to the seller and the user of the power.

The American Farm Bureau Federation and the N. E. L. A. rural lines committee are at work endeavoring to find a method of reconciling the agricultural and the engineering difficulties and thus making possible this great economic development. They realize that electric power will bring a more fundamental revolution in farm life and a saving of waste in food production greater even than the coming of the motor car has wrought, and they are sensible of the urgency of their responsibility. Meanwhile the executives of utility companies are under obligation to familiarize themselves individually with the needs and opportunities of their own neighborhoods, so that when a practical farm service policy is finally perfected they may be ready to apply it intelligently in the service of the surrounding farming country that must look to them for more and better power.

Orin B. Coldwell

An engineer of note and an executive of broad experience who is a recognized leader in electrical activities in the Northwest.

ABOUT 1892, when the electrical industry was still in its pioneer state, O. B. Coldwell, then a high-school boy in Oregon, entered the shops of the Willamette Falls Electric Company, working on arc lamps, meter testing, transformer and armature winding. With a short interval for further education, he has been associated with the electrical industry in the Pacific Northwest ever since. At the present time he is vice-president of the Portland Railway, Light & Power Company in charge of light and power. He is also a recent vice-president of the A. I. E. E. for that district and prominent in the N. E. L. A.

The foundation for this achievement was laid at the time he served as repairman, groundman, lineman, inspector and troubleman, following all this up by a year or two of service as station wireman and operator. About this time he began to think of the need for more knowledge, and the fall of 1897 saw him entered as a student in Stanford University, where he remained for three years. In 1900 he entered Cornell, from which university he was graduated in electrical engineering in 1902.

Upon his return to Portland he resumed work with the Portland General Electric Company and became assistant superintendent of that company. Later he became general superintendent of the light and power department of the Portland Railway, Light & Power Company. Since that time he has become vice-president of the company, maintaining control over the power end of the business. He has, besides, played a very prominent part in the Northwest Electric Light and Power Association ever since its beginning.

Not the least of Mr. Coldwell's contributions to the industry has been in the engineering and economic development of his district. It is under his direction that the work on the present 75,000-kw. Oak Grove project of the Portland Railway, Light & Power Company is going forward. In spite of his standing as an engineer, however, his major work has been along executive lines. He has demonstrated exceptional ability in drawing about him and holding a group of competent and loyal subordinates, and their harmonious co-operation with one another has unquestionably been due largely to Mr. Coldwell's organizing ability. He has a tremendous capacity for work, is filled with nervous energy and has a consuming hatred for red tape. To his clear engineering analysis, combined with executive ability and a way of "getting things done," the electrical industry, and particularly the electrical industry of the Pacific Northwest section of the country, owes much.

Editorial Comment

Electrical World, February 3, 1923

Volume 81 Number 5

Prevalence of Dangerously Low Rates

THE data on central-station output and income that were published in the first issue of the year show in a very remarkable manner the cheapening of electric service due to improvements in the art and to increase in facilities. In fact, the showing is so striking as to give rise to certain misgivings over the rates charged to large users of energy. With a central-station output of approximately fifty billion kilowatt-hours and a gross income of one billion dollars, the average rate for the energy sold during 1922 was thus two cents a kilowatt-hour. For domestic energy the rate was considerably higher than that, indicating that the rate to large power users is becoming precariously low. Even with energy generated from water power there is a serious question as to whether the exceedingly low rates for large power users are justifiable on competitive or any other grounds. The margin is becoming entirely too meager for proper sustenance. Prices for all other commodities have gone skyward whereas the electrical industry has strained every effort and taken advantage of every discovery of science to keep the cost of its output down. The public, or at least the large power user, has derived more benefit from this effort than has the industry, and it would be well for the latter to take thought for its own safety as well as for its obligations to the general masses of the public.

The Tax-Exempt Security Amendment Has Started, but Needs Help

WITH a rocky road ahead and with many barriers to surmount, the proposed amendment to the United States Constitution designed to prohibit further issues of tax-exempt securities was started on its way last week by the affirmative vote of the House of Representatives. For this much those interested in seeing that investment funds are devoted to constructive and reproductive enterprises should be thankful, but more vigorous action is needed in the future than has been necessary in the past. For the further the amendment travels on its way through Senate, White House and thirty-six legislatures the more determined will be the opposition to its passage. The Senate committee has referred the amendment to a sub-committee, and there is activity in various places all over the country aimed against this bill. Fundamentally the debate is whether to do away with the higher surtaxes on incomes or to do away with the tax-exempt security.

Recently Garet Garrett in the *Saturday Evening Post* and Prof. E. R. A. Seligman in the New York *Times* have made convincing analyses to show the positive public good which would result from passage of the amendment in addition to the cessation of the harm which the present system entails. Answers to these and similar defenses of the proposed amendment have for the most part failed to meet the fundamental issues.

Public utility men, engineers and all others in the electrical industry are usually accustomed to face facts and possess the ability to look ahead and not at immediate expediencies. They are in a most advantageous position to see and foresee the evils of the present combination of tax-exempt securities and the graduated income tax, and they will fail in their duty to their industry and to the general social welfare if they neglect study of this question and action upon it. This is not a minor matter.

Possible Consumption of Electricity in Agriculture

FIFTY kilowatt-hours per acre per annum as a practical agricultural use of electrical energy sounds like a fairy tale in the light of the present state of development in America. Nevertheless, it is a serious estimate made for British farms, according to a paper presented before the Institution of Electrical Engineers by R. Borlase Matthews. This paper affords food for thought that must not be missed by central-station men in the United States. The author has had the good fortune to have an experimental laboratory in the form of a 600-acre farm that has given him actual experience in carrying out not only the minor farmstead operations but the major operations of plowing and harvesting. It has also enabled him to try out some operations such as hay curing that seem, in the light of our practice, rather reasonable.

The processes employed in this work are still in an experimental stage, Mr. Matthews declared frankly, but his conclusions leave no doubt as to his belief that electrical energy is destined to play an important part in British agriculture. Competition with the rest of the agricultural world, high railway rates, labor costs and high taxation are facts just as disagreeable to the American farmer as to his British colleague. Profit to the American farmer in the past has come from appreciation in land values rather than from farm operation. The day of cheap land is past, and the American farmer is in a position where profitable farm operation is a vital question. Cheap mechanical power and better mechanical equipment are factors just as important to him as to the British or continental farmer.

It may be that the estimate put by Mr. Matthews on the possible uses of energy is out of all reason, but the realization of one-half the figure would be double the fondest dreams of the most optimistic central-station man in the American field. Anyway, it would be probably ten times the present average usage outside the irrigation field. There is nothing in the methods suggested for plowing by Mr. Matthews that is at all out of line with developments in other fields. For example, the suggested use of cables for plowing is at least comparable with their use in mine work, and as a matter of fact steam rigs of this kind are in use. The real question is how the equipment can be reduced in cost to make it practical for average farm use and make the cost of the operations lower than when carried out in any other way. The account of British

practice deserves careful consideration in this country and ought to stir up research work in American agricultural experiment stations.

No Man Can Long Hold Back the Progress of the Industry

A CONTRACTOR in a New England city wrote in the other day in regard to a "home electric" demonstration which he was organizing. He said: "This will be the first 'home electric' ever exhibited in this locality, . . . We are alone in the project as it seemed too great a task to get the lighting company and the other contractors to agree on essentials. . . . We will not solicit sales of any kind and will hope to reap our reward in publicity and future business." What a picture that statement portrays!

The "home electric" has proved itself the most effective method ever devised for demonstrating to large numbers of people the uses of electricity in the modern home. In city after city the central-station company has got behind the idea and with the co-operation of the local contractors and dealers made it a family affair. More than eighty such homes were exhibited last year to an average attendance of twenty thousand people. The central station is ever the greatest beneficiary, and it would seem that it would be hard to find any executive of any light and power company anywhere who would not eagerly grasp the opportunity to do wheelhorse work in the organization of such a "home electric" urged by a local contractor, and do it without quibbling.

It simply proves again that the electrical industry will wait for no man. The central station is the mother of the local electrical family. It should inspire, encourage and support all local work that has as its objective the promotion of the electrical idea. But where the manager sleeps in a corner, blind to the vision of opportunity which his industry holds out to him, some other man inevitably will come some day to raise the banner and carry it forward. In the meantime how much time is lost for all!

Another Step in Inductive Co-ordination

THE latest report of the joint committee representing the National Electric Light Association and the American Telephone & Telegraph Company adds to the statement of principles covered in the two previous reports an account of approved practices in the construction and operation of both signal and power systems. For the first time since the issuance of the rules of the California Railroad Commission there is now available a set of principles and rules governing inductive interference which cannot be called one-sided. The practices included in the new report cover both those applicable to signal systems and those applicable to supply systems, as did the principles covered in the report made before the Atlantic City convention of the N. E. L. A. last May.

Undoubtedly many will find fault with the new report because certain things are left uncovered and others may not seem to be adequately covered; but the document is in the nature of a progress rather than a final report, and preparations have already been made for research and development which will shed light on subjects that the committee frankly states have not been covered for lack of sufficient data. The important fact that should be recognized is that the committee, after much hard work, has made generally available material on which the practical handling of relations between signal and power systems can be carried out. It represents the best the engineering talent of both industries knows. It is therefore the duty of every man who must face such problems to familiarize himself with the reports of the joint committee and to get behind the principles and practices unreservedly. Only by enthusiastic acceptance and intelligent application can the improvements needed be ascertained. The committee is entitled to the whole-hearted support of the entire electrical industry and, more than that, to honest, constructive criticism based on use and designed to improve the practices on both sides so that the public will have the best signal and power services that can be given.

Evaporator Systems Prove Economical

OPERATING results show that evaporator systems for feed-water "make-up" are successful competitors of water-treating plants. This is true particularly where boilers are operated at high ratings and where electrically driven auxiliaries are used. The capital and operating charges with either system are about equal, but indications point to a reduction in the cost of evaporators which will give the advantage to them. There are other benefits, such as better make-up, reduction in the frequency of "blow-downs" and production of fewer concentrates in the boilers. Room remains, however, for improvement in evaporator operation. Too stiff piping may cause air leakage, and for good results the water they contain must be maintained at the proper level. Neither system will remedy condenser leakage —this is best done by providing treating arrangements for each main unit.

Successful evaporator installations have been made on the basis of the evaporator having little effect on the amount of steam that can be bled from the main units or exhausted from the house turbines. With a low-pressure evaporator and single-stage bleeding sufficient capacity can be obtained, but the recent trend toward multistage bleeding introduces complications. With multistage bleeding it is difficult to get sufficient temperature head, considering the amount of available condensate, to absorb the heat in the vapor from the evaporator, and it is difficult too to get sufficient evaporator capacity. If high-pressure evaporators are used, the temperature of the feed water will be raised, which may so reduce the recovery from the economizers as appreciably to lower the station thermal efficiency.

The great advantages of the evaporator systems lie, as already intimated, in the reduction both of concentrates and of the frequency of blowdowns. The blowdowns affect the station economy, and more and more it is realized that in many stations concentrates are a source of trouble. They are detrimental to piping and valves, clog the superheaters and cause trouble in the turbine blades and condensers. Experience in the use of evaporators shows instances where with a blow-down only once in two weeks the amount of concentrates is very low.

Results from the existing installations point to a more extensive use of evaporators and warrant their serious consideration by power-station designers, even though their comparatively recent entry into the game handicaps their acceptance by conservative engineers.

More Investigation Needed Before Porosity Tests Will Be Conclusive

SOME very interesting porosity tests were described and discussed last August at the Vancouver convention of the American Institute of Electrical Engineers. They deserve careful attention from engineers. The authors, C. C. Farr and H. E. R. Philpott, start with the assumption, quite generally accepted, that many insulator troubles are due to porosity in manufacture and that an accelerated porosity test is highly important. They kept unbroken insulator sections or disks in an aqueous solution of fuchsin dye, at pressures as high as 2,000 lb. per square inch, for several days at a time, thus apparently obtaining the same penetration of moisture as would require perhaps months or years in actual service. They seem to have proved to their satisfaction that insulators which stood such a "soaking" test without appreciable penetration also withstood a subsequent high-voltage test, and vice versa. We seem to have here a promising criterion, both for the maker and the user, of the service to be expected from an insulator.

Of course, penetration tests for porcelain, with and without liquid pressure, have been employed before and are in regular use in some research laboratories in this country, but the assurance of the authors that such a test is conclusive will require further and careful studies. Incidentally, this test again brings to mind the possibility of improving a newly finished insulator before moisture has penetrated into it. An impregnation with some light oil or with molten paraffin (as already suggested by E. E. F. Creighton) under high pressure should seal the pores for a subsequent entry of moisture and thus prolong the useful life of the insulator.

The Coming of the Neon Lamp

FROM time to time a great deal has been heard about small neon lamps being put on the market and becoming fairly common in Europe. In this country they have so far been conspicuous mainly by their absence, but they are beginning to appear and may take their place among the regular lighting devices used for special rather than for general purposes. The brief report on some of these lamps, as tested in this country, printed last week is, therefore, a timely one.

Of course, the neon tube as a spectacular lighting "stunt" had, through the energy of M. Claude, been made known in Europe before the war, but these early tubes were of fairly high voltage and did not have a normal place in central-station activities. The lamps referred to by A. Palme in the last issue are designed for 220-volt circuits, alternating or direct current, this voltage being a usual one in foreign distribution systems. The lamps are likely to be used mainly for advertising and similar purposes, it being possible to obtain a letter-shaped lamp working at an expenditure of not more than 2 watts or 3 watts per letter in the smaller sizes and giving the characteristic neon glow of vivid orange with the faint violet fringe about the electrodes due to a small amount of more refrangible light. The effect is characteristic and pleasing. These lamps may also find useful functions as fuse and switch indicators, polarity testers, and for similar purposes for which it is not now easy to get a lamp of really small size suited to the ordinary distribution voltages. In the United States a night lamp of this type has been adapted to work on 110 volts alternating current, giving a small fraction of a candlepower for an expenditure of energy of less than 2 watts.

Altogether, it would appear that the neon lamp is likely to have a real place in auxiliary service. The actual efficiency is low, the specific consumption of the small lamps here described being about 10 watts or 15 watts per candlepower, but where the only requirement is a very small amount of light for purposes that cannot really be considered within the scope of illumination high efficiency is not important, while the need of a lamp of very low power on circuits operated at the ordinary distributing voltages is a real one.

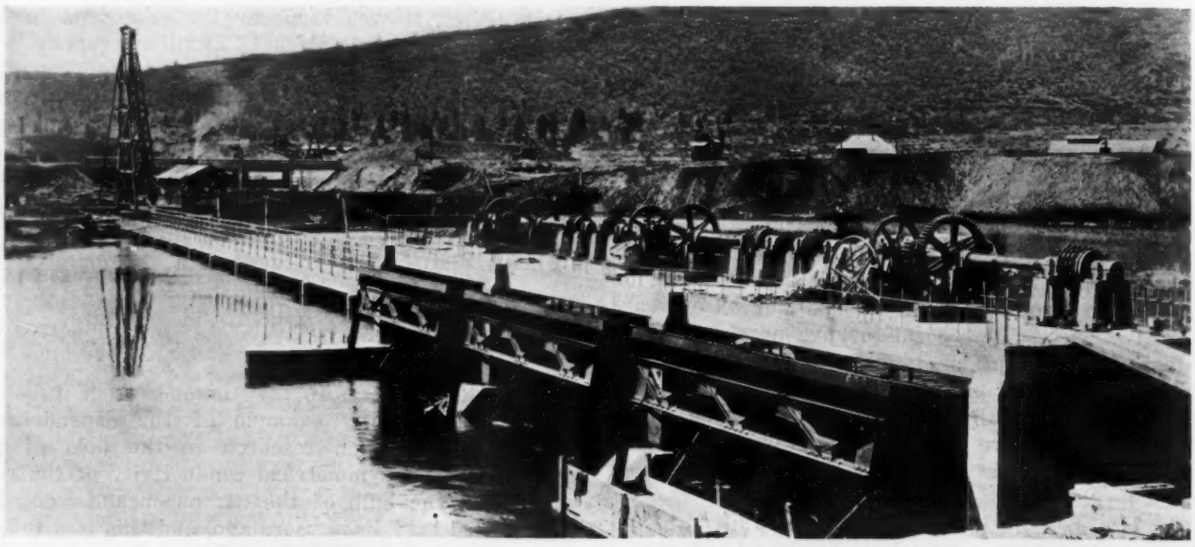
Another New Electron Tube

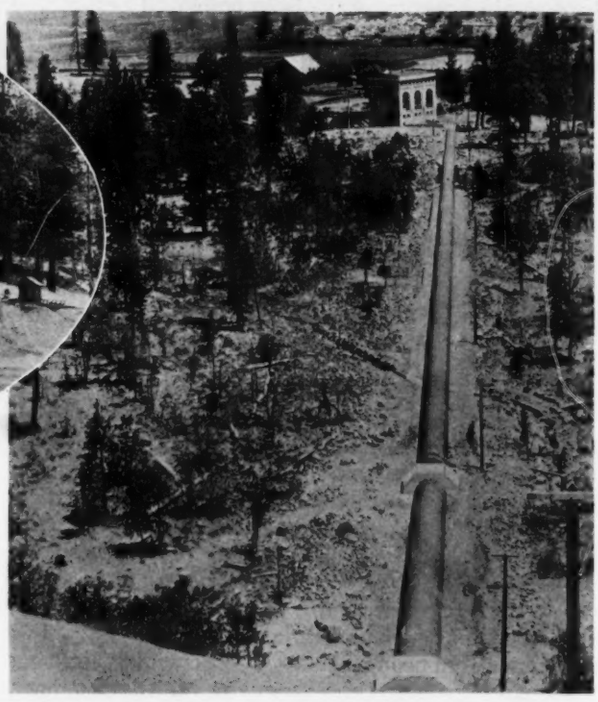
THE development of the three-electrode tube presents a striking example of the dependence of applied science upon research in the field of pure science. The unsymmetrical conductivity of the residual gas in the bulb of the carbon incandescent lamp was noticed by Edison years ago, and this was followed by the discovery by Fleming of the valve action of hot filaments. But it was many years before the work of Thompson, Townsend, Richardson and others on the conductivity of gases and the emission of ions from hot bodies laid the real foundation for the De Forest audion and the subsequent development which is still under way and which really marks a new era in scientific and engineering achievement.

As this careful laboratory study has proceeded hand in hand with the observations of practice, not only have new possibilities been discovered but the limitations of the principles involved have also been laid bare. Power tubes of larger and larger capacity are appearing, but at the same time, when used as detectors, conductivity and sensitivity are seriously limited by space charge and the shape of the current characteristic. The operation of the best-known type of tube depends entirely on the electron emission from the hot filament. But it was soon realized that the conducting properties of gas at low pressures could also be used. Moreover, the control of the filament emission may be accomplished by means of the magnetic field, as well as by the grid potential. Various combinations of these principles have led to a variety of tubes, principally for use in the radio field.

It is readily seen that with two different sources of ions in the same tube, and both under control, it should be possible to alter the form of the characteristics to meet particular needs. The use of this principle is indicated in a new tube described by H. P. Donle at a recent meeting of the Institute of Radio Engineers. Moreover, in this tube a further new source of ionization, the vapor of pure metallic sodium, is used. The tube has the usual hot cathode filament and a so-called "collector" instead of a grid, but the plate is replaced by a pool of metallic sodium which is also heated by the filament current, through the wall of the tube. Greatly increased sensitivity as a detector and other desirable characteristics are claimed by the author, who, however, does not attempt an explanation of the principles underlying its properties. Sodium vapor is known to be readily ionized in electric fields of relatively low intensity, and apparently it is this property in conjunction with control of the filament electron emission which permits the performance shown.

Pit River Basin Development Furnishes 100,000 Hp. Now and Ultimately Will Furnish 500,000 Hp.



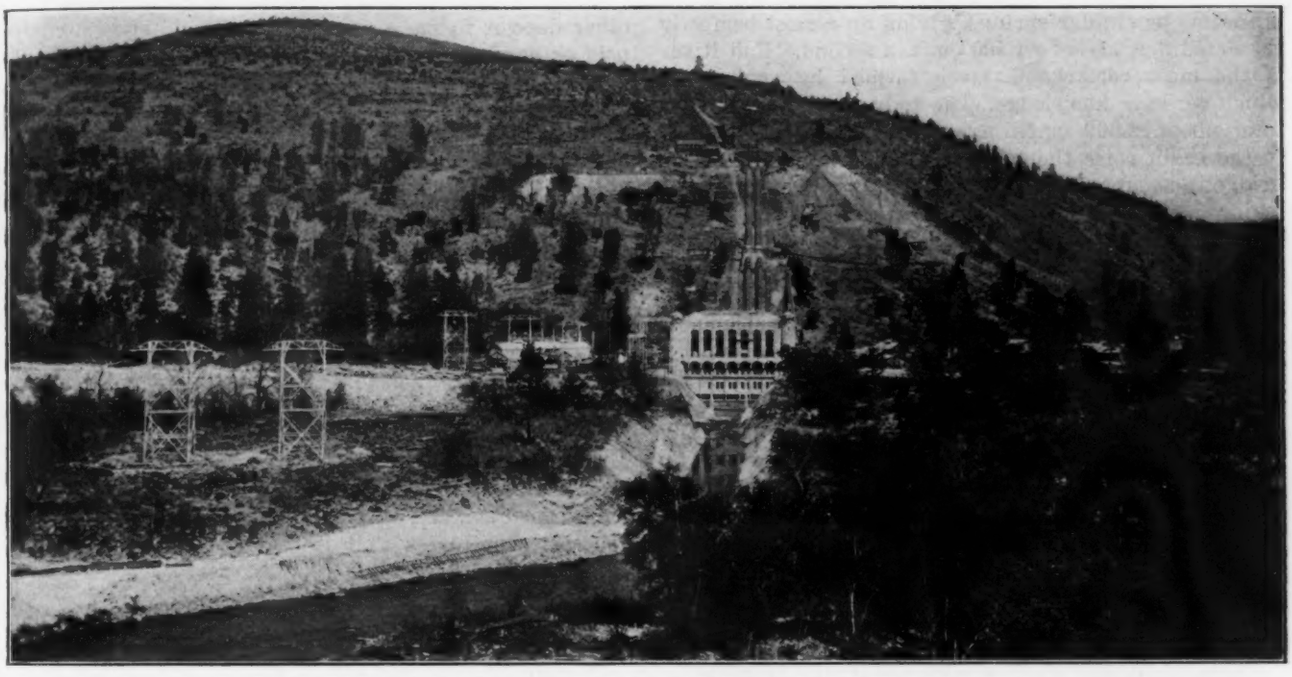


POWER stations will be located at several points in the basin and the energy will supply the San Francisco Bay district over a 220,000-volt transmission line. Views are shown of several existing developments: At the top a view of the head works and intake dam for Pit No. 1 plant is shown; in the center are the two power houses on Hat River which transmit their energy to Pit No. 1 plant at 60,000 volts; at the bottom is the open canal construction for Pit No. 1 plant.

Pit River Power Developments—Part II

An Analysis of the Power Possibilities of This System and a Description of the Plants at Hat Creek and Pit River Utilized in Its Development—Ultimate Possibilities Amount to 500,000 Hp.

By FRANK G. BAUM* and S. BARFOED†



POWER HOUSE NO. 1 ON PIT RIVER AND THE 220,000-VOLT TRANSMISSION LINE

AMONG several important water-power developments carried out in California recently, one, the initial step in harnessing Pit River, has just been completed by the Mount Shasta Power Corporation, a subsidiary of the Pacific Gas & Electric Company. This first step forms a complete unit, composed of three power plants of 95,000 kva. capacity, a transmission line of 200 miles for 220 kv., and a substation for 100,000 kva. at the end of the line. Power conditions in this region are most unusual.

Water and Power Conditions in Pit River Basin

The Pit River basin in northeastern California is part of one of the largest lava fields in the world, its southern end being marked by the north fork of the Feather River, its northern end extending into Canada.‡ This immense lava field has completely covered the original country.

According to geologists, northeastern California was an area of low elevation (an extension of the Sacramento Valley into the Willamette Valley) after the Coast Range and the Sierras were formed. Then came the lower Cascade Range, which extends from Washington to Oregon into northeastern California, its southern line lying roughly along the north fork of the Feather River, and closed the gap between the Coast Range and the Sierras. The southern extremity of the Cascade Range thus formed a dam—in fact, a series of dams—across the outlet of what was the extension of the Sacramento Valley into northeastern California and formed the Pit River basin, covering an area of about 5,000 square miles. Similar small lava dams have later been formed across several of the branch streams of the Pit, namely, Fall River, Rising River, Crystal Lake and Burney Creek.

The precipitation on this immense lava plateau largely sinks through the lava and, being cut off by direct outflow by the lava flows across the old stream channels, is stored in lava-covered storage basins, emerging in very large springs, almost perfectly regulated. Such, roughly, is the explanation of the remarkable water conditions of the Pit River basin, on which about 80 per cent of the low flow of the Sacramento River at Red Bluff depends.

What probably has happened in the Pit River basin, formed by the inflow of the Cascade Range, as explained above, is illustrated in a small way by Burney Creek. A lava flow across the old stream bed lifted it more than a hundred feet, which has resulted in forming Burney Falls. At the falls a spring of about 160 cu.ft. a second rises or comes through the lava layers with almost constant regulation. This amount of water is more than is used by all the San Francisco Bay cities combined. The elevation of the stream bed by the lava flow probably once formed a lake many

*Consulting hydro-electric engineer, San Francisco. †Chief engineer for F. G. Baum.

‡The Pit River, like the Columbia, has cut through the range of mountains called the Cascades.

miles in area. This area has since been filled in by lava débris and now forms a valley, being much larger, however, than the valley that is commonly called Burney Valley. The underground storage basin formed by the lava flow across the stream bed gives us the regulated waters of Burney Falls.

In the Pit River basin, about 8 miles east of Burney Falls, there is a similar spring at Crystal Lake, near Cassel, giving about the same quantity of water as Burney Spring. At Rising River, about 3 miles above Crystal Lake, another spring of about 350 cu.ft. a second rises, and Fall River, about 20 miles to the north, is formed by similar springs, giving an almost perfectly regulated flow close to 1,500 cu.ft. a second. Fall River is the most remarkable river formed by springs of which we have knowledge. The four springs mentioned total about 2,300 cu.ft. a second, and other springs in the basin raise the total for Pit River above Peck's bridge to about 2,500 cu.ft. a second. Pit River, formed mainly by the above springs, has its source east of the summit of the Cascades and has cut its way through the range to the Sacramento Valley.

The total economic power drop available is more than 2,000 ft., and we have therefore possible dependable power developments on the Pit River close to 500,000 hp. constant. This power it is planned to take to the San Francisco Bay region, the initial step now being in operation. The power output could be practically constant, as storage sites are available to make up the summer deficiency of about 10 per cent, which is largely due to irrigation and evaporation. The water supply of the Pit and its branches is for power purposes the most continuous contained by any stream known. This stream also furnishes underground water storage for the irrigation of the Sacramento Valley lands of more than 1,000,000 acre-feet per year.

These spring-fed streams therefore demand a different solution in their development from that demanded by most other streams in California. There will be no large storage reservoirs with costly dams, and only very moderate floods occur. Such floods as do occur come chiefly from the upper reaches of the Pit, where the character of the watershed changes. The maximum flood before the inflow of Fall River is about 30,000 cu.ft. per second.

The three first developments utilize water from tributaries only, and these streams are without floods as the term is ordinarily understood, their water surface varying only from a few inches to half a foot during a season. There is little surface run-off on these tributaries, as rain and melted snow at once sink into the porous lava, find underground channels and come to the surface at some place where a tighter basaltic flow or other deposit forms a dam across the old stream channels or canyons.

TABLE II—EQUIPMENT INSTALLED

Plant	Main Turbines			Main Generators				
	Maximum Hp.	Speed, R.P.M.	Draft Tube	Kva.	P.F.	Voltage	No.	Total Kva.
Hat Creek No. 1	15,000	225	Straight and flaring	12,500	0.8	6,600	1	15,000
Hat Creek No. 2	15,000	225	Straight and flaring	12,500	0.8	6,600	1	15,000
Pit River No. 1	40,000	257	Hydraucone	35,000	0.9	11,000	2	70,000

The tributaries utilized in these first developments are Fall River and Hat Creek. These two streams furnish the major part of the low-water flow of the Pit. (See map on page 266.)

Fall River is only 15 miles long from its spring source to the Pit and comes from the north, rising in the upper end of Fall River Valley, formerly a large lake. It enters the Pit over a 55-ft. fall. The combined streams have cut their way through the Mount Lassen volcanic ridge, forming a gorge with nearly vertical walls where the successive eruptions show in cross-section like a layer cake.

Hat Creek enters about 8 miles below, coming from the south. The upper reaches drain the north slope of Mount Lassen. The real flow of Hat Creek comes from Rising River, 6 miles upstream from the mouth, and from Crystal Lake, 3 miles upstream. (See map for series of plants that it is proposed to develop on Pit River.)

HAT CREEK AND PIT RIVER NO. 1 DEVELOPMENTS

The total drop utilized at Hat Creek is a little more than 400 ft., split by nature into two heads of about 200 ft. each, and 2½ miles apart. The topography is such that they could not have been combined, and the water from Crystal Lake and other springs could not have been utilized through the conduit.

The power developed is not fed directly to the transmission line to the bay region, but is sent over a 60,000-volt line to Pit River plant No. 1, where it is stepped down to 11,000 volts, and over the 11,000-volt bus system to the 220,000-volt transformers and to the line for transmission to the San Francisco Bay district.

The name of the plant known as Pit River No. 1 is due to the fact that the power house is on the Pit, although it utilizes Fall River water. A tunnel pierces the intervening ridge, as shown on map. The 220,000-volt transmission line starts here, and the plant is an energy center for four plants, Hat Creek Nos. 1 and 2

TABLE I—HYDRAULIC STRUCTURES

Plant	Diversion Dam			Conduit					Pipe Pressure			
	Kind	Maximum Height, Ft.	Length, Ft.	Kind	Cross-Section	Length, Ft.	Maximum Capacity, Sec.-Ft.	Head, Ft.	Kind	No.	Diameter	Length, Ft.
Hat Creek No. 1	Rock-filled timber crib	7	211	Unlined canal	17-ft. bottom width, 9.5 ft. deep, side slopes 1½:1.	2,750	600	215	Riveted steel	1	10 ft. to 8 ft.	1,650
Hat Creek No. 2	Rock-filled crib and piles	16	460	Timber flume	7 ft. x 16 ft., 3 in.	4,700	800	194	Riveted steel	1	10 ft. to 8 ft.	400
Pit River No. 1	Concrete	15	600	Lined canal and tunnel	50-ft. to 22-ft. bottom width, 10 ft. to 25 ft. deep.	1,100			Riveted and welded steel	2	10 ft. 9 in. to 9 ft.	330
					Horseshoe 154 sq.ft. (equal to 14 ft. diameter).	10,160	1,800	454			9 ft. to 8 ft.	1,140

and Pit River Nos. 1 and 2, of which Pit River No. 2 is yet to be built. The principal facts concerning these plants are given in Tables I and II, and their location is indicated in the map.

It is thought that the electrical features of these plants will be of greater interest to the readers of the ELECTRICAL WORLD than the hydraulic feature, and the former will therefore be described at greater length.

EQUIPMENT OF HAT CREEK PLANTS

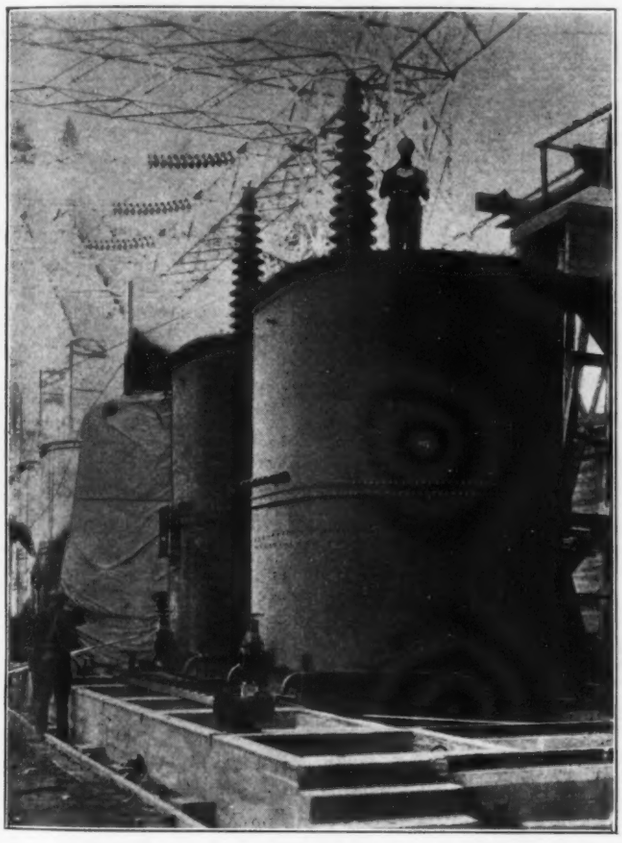
As stated previously, the power from Hat Creek plants Nos. 1 and 2 is transmitted to Pit River No. 1 over a 60,000-volt double-circuit tower line about 3½ miles long. This course was taken so that 60,000 volts would be available for distribution and also to reduce to a minimum the trouble from atmospheric disturbances, thus placing reliance on the step-up and step-down transformers rather than exposing the 11,000-volt generator windings, if the transmission was at generator voltage.

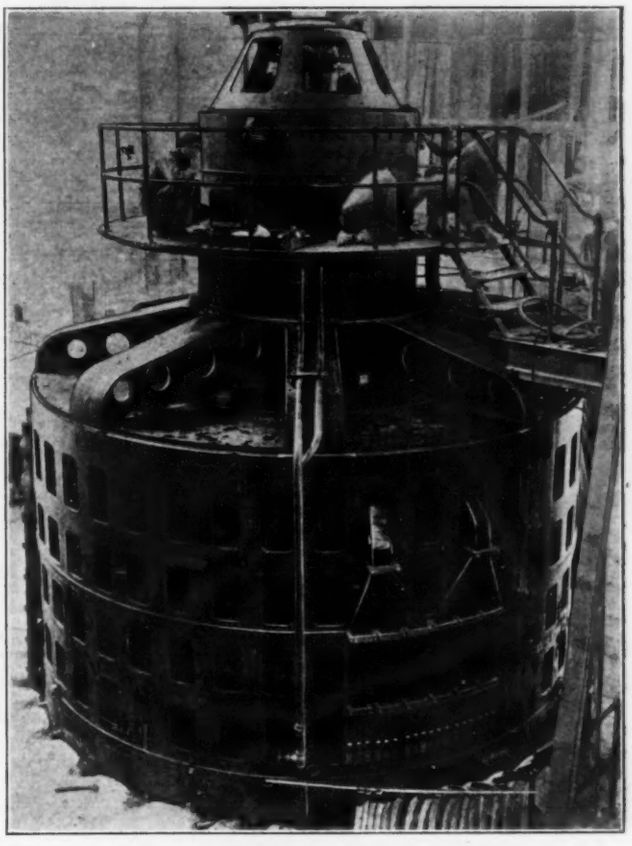
The equipment in the two Hat Creek plants is identical, although there will be considerable difference in the kilowatt-hour outputs. When conditions warrant it will be possible by the use of pondage on Rising River to increase the peak capacity of Hat Creek Nos. 1 and 2 so as to utilize the equipment more fully.

The main units are vertical-shaft, one in each station, with exciters separately driven by double-nozzle impulse wheels. Owing to the constant flow characteristic of the stream, there is very little fluctuation permitted in the load, a load-limiting device on the governors preventing an overdraft. There is no governor on the exciter wheels, but control of the nozzle setting is had from the switchboard through two small motors and a gear train mounted directly on the nozzle body, one for each needle. There is nothing new in the switching equipment of the Hat Creek plants, and as is now common the generators are protected against internal trouble by balanced relays, the neutral of the windings having been leaded out for the purpose and being also solidly grounded. The three-and-one-half-mile 60,000-volt double-circuit line is relayed to trip out on insulator flashovers selectively. One bank of transformers serves at each station to step up from 6,600 volts to 60,000 volts. At Pit River No. 1 the voltage is stepped down through one bank to 11,000 volts, which is the low-tension bus voltage at this plant.

EQUIPMENT OF PIT RIVER PLANT

The Pit River plant has attracted more attention on account of the 220,000-volt transmission line starting here. Since the bulk of the market for Pit River power will be in the large district around San Francisco Bay, it was necessary to transmit a little over 200 miles to the first substation and eventually 275 miles to the second substation. Economically this could best be done at 220,000 volts.





VIEW OF THE 220,000-VOLT, 16,666-KVA. TRANSFORMERS AND 30,000-KVA. GENERATOR USED IN PIT NO. 1

Such a line imposes at once certain conditions to be fulfilled by the generator equipment, which is that it must be of sufficient capacity to handle the charging current not alone from a kilovolt-ampere standpoint, but also as regards self-excitation due to the charging current at light load furnishing magnetizing power. The field excitation for this condition is reduced to a minimum by cutting in resistance in series with the field automatically. The generator is then capable of supplying 90 per cent of its full-load current at zero power factor leading, with a terminal voltage of about 82 per cent of normal. The two machines in Pit No. 1 are

rated at 35,000 kva. with 90 per cent power factor lagging, 11,000 volts.

The selection of switching equipment had reference to the total amount of ultimate generating capacity which can be concentrated on the 11,000-volt bus. This ultimate rating is 115,000 kva. The double-bus system is used.

SIMPLICITY CONTROLLED DESIGN

The controlling idea in laying out the switching equipment was to avoid the necessity of building several stories to house it. Simplicity controlled the designs. Accordingly all heavy low-tension switches are arranged on the generator-floor level in an adjoining and separate low part of the building, extending to the rear and forming a T with the main generator room. (See Part I, issue of Jan. 27.)

All high-tension switch equipment is installed out of doors, also at generator-floor level. Thus all heavy equipment may be trucked under a crane in the generator room with a minimum of rigging.

The control board, instrument and relay board, exciter board and station-service boards are in the generator room on an elevated platform 13½ ft. above the floor, all housed in a neat glass-covered canopy giving miximum light and keeping out dust and noise. The generator-field rheostats are installed below this platform between the generators.

The voltages in this station are: Ultimate high tension, 220,000; low-tension or generator voltage, 11,000; auxiliary power equipment, 440 (motors); lighting, 110, alternating or direct current; excitation, 250; battery for control circuits, 125.

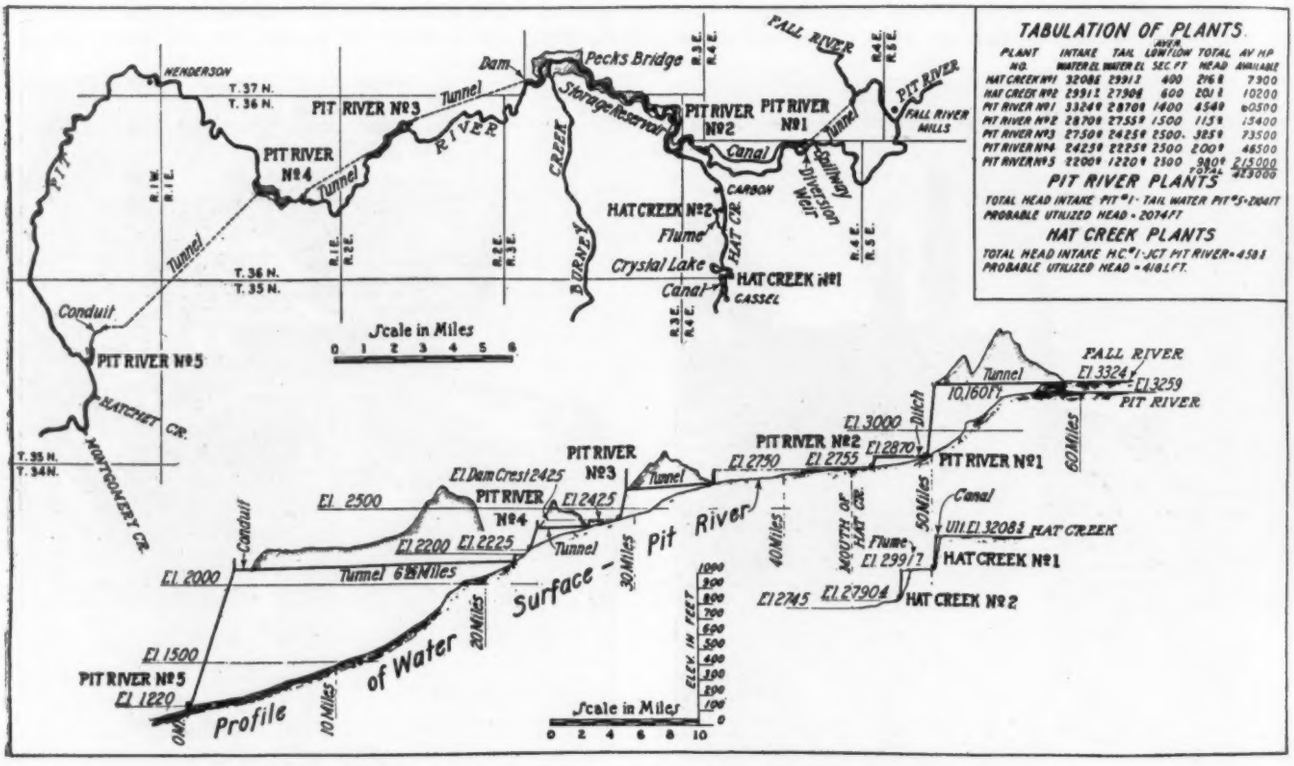
The exciters are mounted on top of the vertical generators, and each is of 225 kw. capacity. A spare of the same rating is arranged to be driven by an impulse wheel or by an induction motor which is mounted on the same shaft.

There are two banks of three transformers, each with one spare unit. The high-tension voltages which may be obtained from them are 125,000, 175,000 and 220,000. Experience is to be gained from operation at all three voltages successively, but it is thought that in less than a year full voltage will be used all the time. The connection is star high-tension, delta low-tension. On the high-tension side the connections are single-terminal, taken out through a weatherproof condenser bushing. The other end of this winding is grounded through a current transformer mounted on the cover plate of the transformer casing. Relay protection is had through this current transformer and bushing transformers on the high-tension oil switches.

Cooling water is taken from the penstocks through a tank half way up the hill reducing the pressure. A rather complete oil-handling outfit is provided for storing, handling and filtering. The tank system consists of three 10,000-gal. tanks, placed in the open, in a reinforced concrete valut, below general ground level, so that new oil as well as oil from transformers and switches will flow to them by gravity. A complete yet simple piping system connects the tanks with the apparatus, and the connections are such that any mixing of the different oils can be prevented.

SWITCHING EQUIPMENT

The 220-volt switching equipment is installed out of doors. The oil circuit breakers are equipped with a bypass arrangement whereby any of them may be taken out of service for repair or inspection. The bypass is provided by a combination of three air-break disconnecting switches mounted on a structural steel framework surrounding the breaker, the whole combination



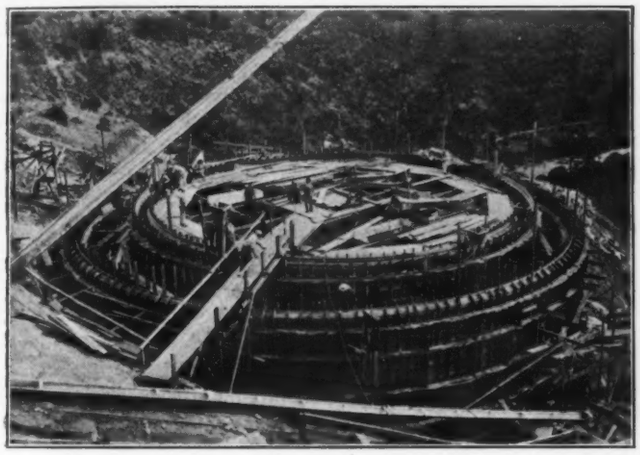
PLAN AND PROFILE OF THE CONTEMPLATED 400,000-KVA. DEVELOPMENT ON PIT RIVER

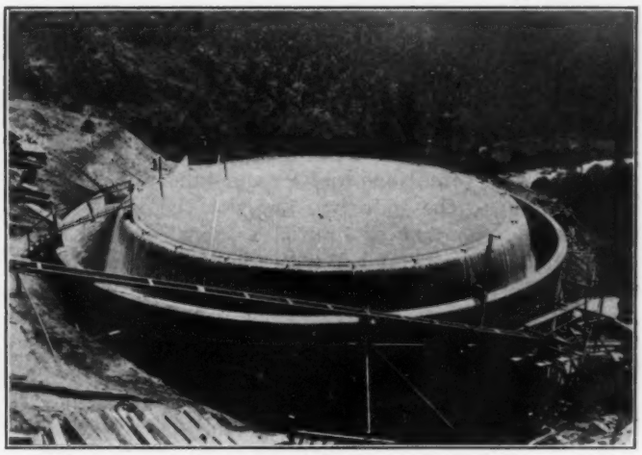
forming a distinct unit. The air breaks open in a plane parallel with the conductors with one or two gaps in series. Contacts and metal projections are covered with corona shields.

At present the total number of oil breakers installed is three, one in each line and a tie breaker. There is space provided for adding two more on the transformer side. Two air-break disconnecting switches will take their place now and will later be used in the bypass arrangement when the full equipment of breakers has been installed. The total number of breakers then will be five. These breakers serve two 220,000-volt lines and two banks of transformers which are of 50,000 kva. rating each.

DOUBLE BUS USED ON LOW TENSION

The low-tension switching system is operated at 11,000 volts, with a double bus. The main equipment consists of fourteen oil circuit breakers with their disconnecting switches, all mounted in concrete cellwork.





VIEW OF SURGE CHAMBER FOR PIT RIVER NO. 1 WHILE UNDER CONSTRUCTION AND IN ACTUAL OPERATION

Here also are mounted the necessary current and potential transformers, with the exception of the current transformers in the ground leads of the generators, which are mounted near the machines. The potential transformer fuses with limiting resistors and disconnecting switches are mounted similarly to the main disconnecting switches.

The oil circuit breakers are of the heaviest type available at time of purchase. The current-carrying capacity varies according to the service. These breakers are: For Hat Creek Nos. 1 and 2, incoming lines, four, rated at 2,000 amp.; for transformers and outgoing lines, four, 3,000 amp.; for generators, four, 2,000 amp.; for station power and exciter transformers, two, 400 amp. The disconnecting switches which are used to isolate these breakers have corresponding current capacities.

The double bus extends overhead between switch groups, each phase being in a concrete cell. The switch groups are mounted two and two, with a passage between each group and disconnecting switches to the rear of each breaker. This arrangement prevents a wrong set of disconnecting switches being opened. The three doors for each set of these switches open together by a single mechanism with only one lock. Indicating lamps are also provided.

To place all of the equipment at generator-floor level, the breakers are what is known as back-connected; that is, the terminals of the breakers are brought out at the rear above floor level. Usually these types of breakers are bottom-connected, requiring a different mounting from the one adopted. The direct current needed for actuating the motor-operated breakers is supplied by a storage battery having an instantaneous discharge current of about 500 amp. at 125 volts.

A motor-generator charging set is provided for this battery and installed on the switchboard gallery. The battery also furnishes energy for operation of high-tension solenoid-actuated breakers, generator-field circuit switches, emergency lighting, etc.

As at Hat Creek the neutral of the generator is brought out for balanced relay protection. In addition, if a fault develops in the generator winding, the balanced relays operate to actuate the governor to close the turbine gates in order that the energy fed into the faulty winding may be reduced as quickly as possible. A latch is also tripped in the operating levers which control the air-discharge dampers, shutting off the ventilating air as much as possible. The machines are also equipped with powerful air-operated brakes which are able to stop any unit very quickly.

The water turbines were furnished by the Allis-Chalmers Manufacturing Company, the guarantee being 40,000 hp., but they give about 44,000 hp. Official tests have not yet been made. The generators were also furnished by Allis-Chalmers. The step-up 220-kv. transformers were furnished by the Westinghouse Electric & Manufacturing Company, and this company also furnished the high-tension switches. The switchboard and low-tension switch equipment was furnished by the General Electric Company.

The tunnel and canal contract was let to F. Rolandi of San Francisco. All other contractors assumed a wet tunnel in bidding, but, as predicted by the engineer, the tunnel proved perfectly dry. The engineering designs from the intakes for the water conduits clear through to the 110,000-volt busbars at the Vaca substation were handled by S. Barfoed, chief engineer for F. G. Baum. The result is one of the best pieces of hydro-electric design work in the world, considering the variety of the problems, the magnitude of the work and the money involved. The principles controlling were simplicity of layout to meet the conditions, and the use of a few high-class designers, rather than a large number of draftsmen, has resulted in a piece of hydro-electric work of which all are proud.

Uses of Electrical Energy in Agriculture

Electrification of Plowing, Harvesting and Other Farm Operations Can Develop Annual Energy Consumption Exceeding 50 Kw.-Hr. per Acre for 150-Acre to 600-Acre Farms, According to British Experience

ASSERTING that experience on the European Continent shows the annual consumption of electricity in farm buildings alone to be proportional to the size of the whole farm and to average 10 kw.-hr. an acre, R. Borlase Matthews, in a paper presented in Great Britain before the Institution of Electrical Engineers, estimates that the probable energy consumption on a well-equipped farm should total 44 kw.-hr. per acre of arable land for plowing, cultivation, electroculture, electric silage, harvesting, etc. The figures in question were worked out from a study made by the author of results attained on the continent and in England and from experience in the operation of a 600-acre farm of his own. He concluded that, as in all other industry, the successful solution of the application of electricity to farming is not merely a matter of belting a standard motor to existing machinery. The conditions and circumstances of farming are peculiar to the industry, and not the least of the problems is the fact of limited seasonal use of much of the machinery, coupled with the further fact that a large portion of the labor available is prejudiced against and unused to machinery in any form. The author's opinion is that in the future the use of electricity in the operation of farms will be essential from the points of view both of cutting down the total cost of labor and power and of obtaining an increased output. If the efficiency of farming is to be improved, a change from present methods is imperative, and Mr. Matthews maintains that an increased efficiency, including circumvention of adverse weather conditions, is easily obtainable by using electrical energy.

While the main or transmission circuits may be at any potential over 50 kv. in Europe, the distribution is becoming standard at 10 kv., three-phase, 50 cycles. The final voltage for farm supply is 380 volts for three-phase motors and 220 volts for lighting. The distribution circuits are four-wire, the fourth wire being the neutral from which the single-phase lighting circuit is obtained in connection with one of the phase wires. The useful minimum size of transformers is 50 kva. From this transformer distribution lines can be conveniently run in any direction for a distance not exceeding 2,500 yd. (2.3 km.). In Denmark on this class of service a conductor corresponding to No. 4 A.W.G. is used, and on the heavier loads a wire corresponding to No. 2 may be employed. To compensate for the line drop, motors rated at 10 to 15 per cent lower voltage than the normal line voltage are used. The same rate difficulties experienced in the United States seem to plague the central-station men of Great Britain and the continent.

Milking machines, water pumps, cream separators and other dairy equipment, electric light, electricity to stimulate the production of eggs, incubator heating, household appliances and other smaller fields for the use of electricity seem to have had about the same consideration as in the United States. Electroculture and the use of electrical energy for the major operations have received greater attention both in England and on the continent than has been the case in the United States, and while the developments are admittedly in the experimental stage, some very interesting things that are worthy of attention in this country are described.

Plowing by the use of electrical energy has received a considerable amount of attention. Mr. Matthews gives consideration to five methods. The first is that in which the storage battery is used, and this method is dismissed with the remark that the equipment is too heavy, packs the land excessively and cannot be used on soft ground. The plow with a trailing supply cable provides a heavy piece of equipment with a cable winding gear that is unsatisfactory and a great deal of wear on the trailing cable itself. The third method involves an electrically hauled plow on the Fowler steam system, the fourth one with a modified Fowler system employing a single cable-winding device, and the last an outfit based on the "Roundabout" or Howard steam system. The characteristics of the last three systems are shown in Figs. 1, 2 and 3.

The objection to the double-haulage Fowler system is the cost of equipment. Motors rated at 80 hp. to 100 hp. are required. The system compromising between the Fowler and the Howard systems is characterized as the most practicable for ordinary farms. The outlay for the straight Howard equipment is reasonable, the power required is from 12 hp. to 60 hp., and anchorage difficulties are not nearly so great as in the Fowler system. The tackle comprises a single electric motor with two haulage rope drums, either of which can be driven by the motor while the other pays out the cable. The haulage cable is arranged to follow around the sides of the field, and at two corners anchored angle pulleys are provided. Cable pulley wagons are anchored at the other corners of the field. The plow is hauled from one anchor wagon to the other, and when turned for the next set of furrows the anchor cable on the wagon next the plow is slacked off so that the wagon moves ahead the width of these furrows.

Some data on energy requirements and the amount of land plowed per hour at different furrow depths are given in the table. These data are taken from experiments with an electric haulage set of considerably

ENERGY REQUIRED FOR PLOWING PREVIOUSLY CULTIVATED SOIL AND WORK PER HOUR WITH ELECTRICALLY DRIVEN PLOWING SET

Made by the Société Générale Agricole. This set works on the Fowler system. A 50-hp. gas engine provides the means of moving the set, which uses a 100-hp. electric motor and 1,100 yd. of trailing supply cable for 5,000-volt service.

Depth of Furrow In.	Work per hour, Acres	Consumption, Kw.-hr. per Acre
6	2.5 to 2.75	14
From 8½ to 10	1.87	18
10 plus 6 of subsoiling	1.25 to 1.38	36 to 40

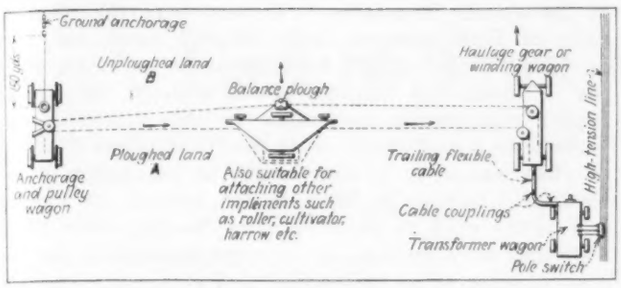


FIG. 1—ARRANGEMENT OF ELECTRIC PLOW SET ON THE FOWLER STEAM-PLOW SYSTEM

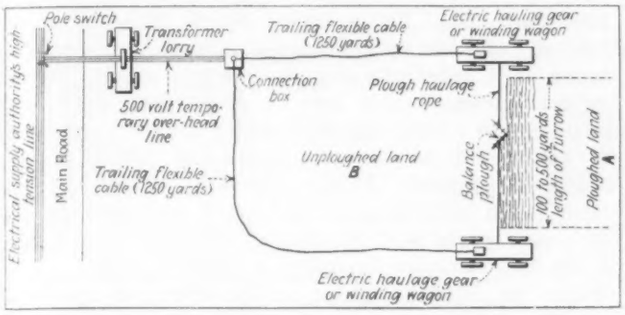


FIG. 2—MODIFICATION OF FOWLER SYSTEM WHICH USES ONE CABLE

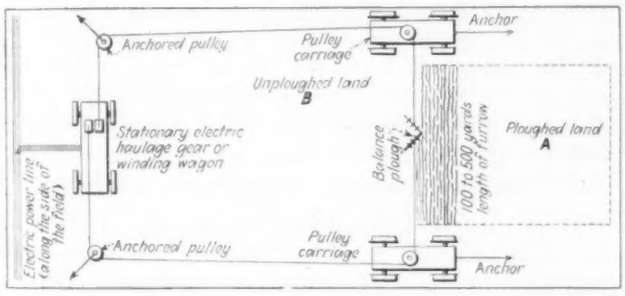


FIG. 3—ELECTRIC PLOW ON THE ROUNDABOUT OR HOWARD SINGLE-CABLE SYSTEM

This is said to be the most practicable for use under British farm conditions.

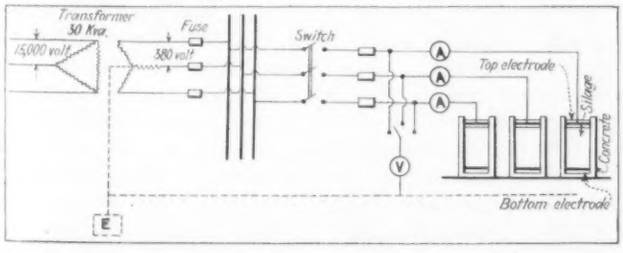


FIG. 4—ELECTRIC PREPARATION OF SILAGE CLAIMED TO PROVIDE A BETTER PRODUCT

Nearly 100 installations of this kind are said to be in use in Germany.

greater capacity made by the Société Générale Agricole. The energy requirements are dependent on the resistance of the soil being plowed. On such sets as illustrated speeds of 3 ft. (0.9 m.) and 5 ft. (1.6 m.) per second are provided, and by a change of gears 4 ft. and 7 ft. (1.3 m. and 2.1 m.) per second can be had. The practical furrow length even on very large fields rarely exceeds 450 yd. (381 m.). A large haulage set will plow 19 acres to 20 acres (7.7 hectares to 8 hectares) per day.

"Unfortunately," Mr. Matthews remarks, "the problem of electric plowing is not merely a matter of solving electrical difficulties. It involves also a careful consideration of the design of the implements to be employed. Though agriculture is such an ancient art, or perhaps because of this, the scientific principles of the design of even such features as plowshares do not seem to have been so carefully investigated or mathematically analyzed as they should have been." The use of the best possible mechanical design, including ball bearings, is recommended for all equipment, and special attention should be paid to foolproof equipment requiring the minimum of skilled attention.

Electric drive of harvesting equipment seems to be of the partial type, the machines being hauled by a tractor which also carries a small generator to supply a motor of approximately 1½ hp. driving the cutting and binding parts of the harvester. The constant speed of these parts, owing to their being independent of the speed at which the harvester must be drawn, is said to make for better handling of crops, particularly those that are down and badly tangled. With electric motor drive it is claimed that crops can be cut at a rate about one-third greater than normal with ordinary equipment. Mr. Matthews says that the combined harvesting and threshing machines used in America (known in the West as "combines") cannot be used in Great Britain owing to the need of curing the grain before threshing because of climatic conditions. To overcome this difficulty some experiments have been conducted in the effort to cure and dry the grain with the air from electrically driven fans. The combined machine is essentially one that should be electrically driven. Experiments which have been made with the electrically driven thresher seem to indicate a labor saving.

The English practice in threshing involves more farmyard and less field work than in the United States, and therefore American practice may involve more difficulty in getting a supply of energy. Motors of about 12½ hp. seem to fit this character of work. Mention is made of equipment supplied by English manufacturers for which threshing operations are carried out in two stages, the first leaving an uncleaned grain for farm use and the second cleaning and preparing all the grain for market. For this work a 5-hp. motor is sufficient for each operation.

An interesting development in the preparation of silage is outlined by Mr. Matthews. Each silo is equipped with a grounded electrode at the bottom and a live electrode which can by placed on top of the green stuff stored in the silo. Germany already has nearly one hundred examples of such silos. Ten tons of fodder are said to require between 130 kw.-hr. and 200 kw.-hr., and the time for treatment in a silo varies from twenty-four to forty-eight hours. Better preservation of the silage due to the arrest of harmful bacterial action is claimed.

In making hay artificial curing is carried out by running a wooden duct into the base of the stack and air from an electrically driven fan under water pressure of 2½ in. is blown into the stack. The rate of drying is inversely proportional to the amount of moisture in the air. The artificially dried hay is said to look better, has a better aroma and the food value is held to be better because of prevention of high temperatures in natural curing that destroy food values and may even set the stack on fire. In connection with this form of use of electrical energy it is recommended

that measures for curing fruit, vegetables and other products be made. In this way a more economical installation can be obtained, and many things that would otherwise be wasted can be made useful.

Regarding the farm load factor Mr. Matthews says: "A somewhat difficult query has been put forward asking for the probable load factors of a 300-acre and a 600-acre farm. . . . Different farmers will have different ideas as to the most suitable equipment for their work. On an intelligently equipped farm a load factor of 33 per cent may be anticipated." For dairy, mixed and arable land farms he gives load factors of 13, 15 and 31 per cent respectively for the farm only. With the addition of farmhouse lighting, cooking and part heating he raises the figures to 24, 25 and 33 per cent, respectively.

"Since the size of farms in any neighborhood varies considerably," Mr. Matthews observes, "it is useless to make the assumption that if a 600-acre farm has a demand of 25 kw. the central-station demand would be 25 kw. per square mile. In any event the supply undertaking would run its lines along the route of the maximum demand, and continental experience shows this practice to be advantageous in units of 50 kw. Further, farms cannot be considered apart from rural industries and the varied demands of even small villages in the same neighborhood."

Reference has been made to the difficulty of arranging the distribution system on a farm, more especially for the field work. This is not so troublesome as might at first be anticipated, the author of the paper says. Since each stationary plowing gear has to be brought into only one corner of the field it is merely necessary to bring the distribution lines within reach of the plow flexible electric cable, which is usually over 100 yd. in length. However, on the continent, to economize in copper, the posts and insulators are installed permanently and the copper lines are moved about as required. The author has one transmission line crossing his farm (of 600 acres) and has planned one other line at right angles to this. He hopes that this simple arrangement will be sufficient for all the farm field requirements.

Since a large amount of power is used on a farm in the course of a year, it is a very serious question what form of power should be employed. In England the horse is in universal use, aided nowadays very largely by the oil tractor and steam plow. It is improbable that the horse will entirely disappear, though he is a costly animal to keep. At Greater Felcourt Farm in 1919, without any overhead charges, the cost per horse, including a part of the driver's time, worked out at £147 (about $715). This compares with the figures of well-known agricultural writers, Fream and Parkside. Electricity at 2 shillings (48 cents normally) per kilowatt-hour would have been far cheaper than horses for work to which it would have been applicable. On a small farm where an electric supply is available one horse should suffice, and on a 600-acre farm the number should not exceed two or three, Mr. Matthews thinks. He himself keeps three horses on his 600-acre farm and hopes shortly to reduce this number to two.

Mr. Matthews goes on to say: "It is not a sound principle to reduce the number of men; rather, the object of each farm should be to increase the output and profits by farming more intensively. It has already been stated that nine-tenths of the farms in this country [Great Britain] compete in growing products with the world, hence their fortunes must vary with the rest of the world. Therefore, it is very important that, in spite of high taxation, high railway rates and high costs, the output should be a maximum at a minimum cost. Cheap and suitable power will, in the future, render considerable assistance in this direction, and experience shows that a great deal of this power should be electrical. . . . The farmer is not going to use electricity because he loves it, but because he finds it will do the work he requires more cheaply, more effectively and more quickly. . . . One speaker in the discussion referred to the necessity of going over the land eight times with horses for the preliminary cultivation work, but with mechanical power five or six times suffices. This alone means a considerable saving of time and cost. The so-called handy little oil engine (already obsolete on continental farms) has been advocated as a substitute for the electric motor, but the author knows, to his cost, a great deal about such engines. In a farm laborer's hands they are not nearly so convenient as the manufacturers' catalogs would appear to suggest. In the course of a year the total time taken in tinkering with such engines, the cost of repair parts and the loss of time in getting work done, etc., amount to quite a serious figure. . . . While the British farmer is far ahead of his continental neighbors in animal breeding and pasturing, he is far behind in intensive agriculture and the use of electricity. Enormous scope still exists for improving farming by attention to important details. It will be easier for the farmer to take up improved methods if at the same time he makes use of what to him is a new power, because it facilitates the handling of his very conservative men, as the author has discovered in many instances."

WHERE AMERICAN CONDITIONS DIFFER

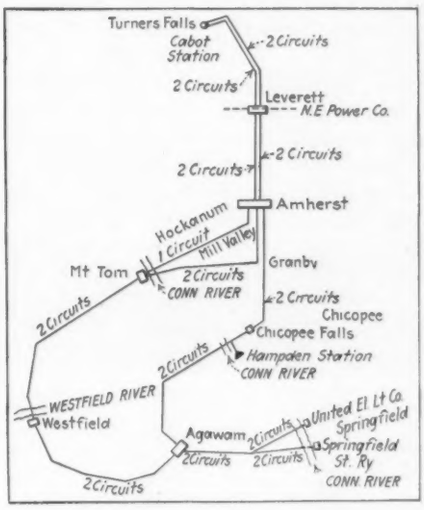
In quoting the above figures on the cost of the horse it should be borne in mind that they are undoubtedly very much out of line for American conditions. Depending on what part of the country is considered, the cost of the horse in the United States seems to be between $100 and $200 per year, and in sections where pasturage is cheap the cost will be below $100. These figures are only approximate and for comparison with the figures given should be added to the cost of the driver. The point of the remarks so far as American conditions are concerned lies in the lines of investigation indicated. This applies to all of the data covered briefly in this article, since methods and conditions are such that direct application of the methods of using electricity on European farms might lead to serious error.

The outstanding fact is that electrical energy has been used in operations that have seemed the last to be considered in the United States. In the paper quoted, an estimate of 50 kw.-hr. per acre per annum has been made for farm use of electrical energy. The farms talked about are from 150 acres to 600 acres in size. Irrigation is not a factor. For American farms that are comparable one must look to the Middle West or the Eastern States. At present the data available seem to indicate a consumption on these farms of only 1 kw.-hr. to 5 kw.-hr. per acre annually, with the latter figure a very unusual one. Of course, there are some farms where greater use of electrical energy may be found, but it is for special purposes. That there should exist such a discrepancy between the British estimate of 50 kw.-hr. per acre and the present American use of less than 5 kw.-hr. gives food for thought.

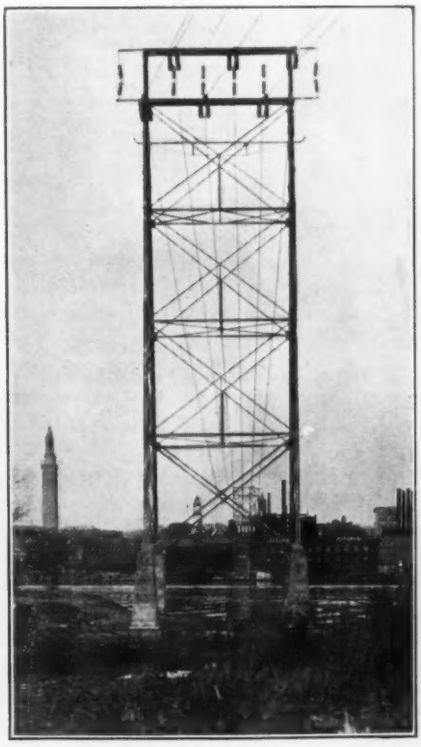
Cost of Transmission Lines

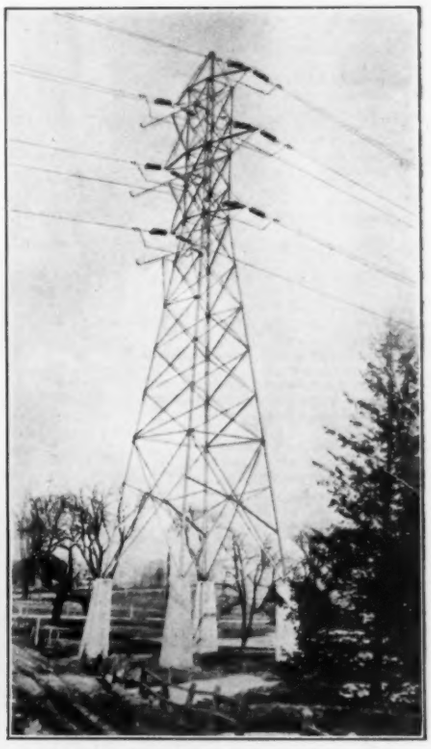
General and Price Data on the 78-Mile System of the Turners Falls Power & Electric Company, Which Connects Turners Falls with Springfield, Mass., and Serves the Connecticut Valley from Both Steam and Hydro-Electric Plants

A COMPREHENSIVE summary of the investment cost of the 66,000-volt transmission lines of the Turners Falls (Mass.) Power & Electric Company, one of the largest transmission organizations of New England, was completed not long since in connection with a security issue for which authorization was asked from the Massachusetts Department of Public Utilities. The company operates hydro-electric and steam generating plants in the central Connecticut Valley and is interconnected with the New England Power Company and the United Electric Light Company systems. A line is at present under construction between the Connecticut Valley and the Berkshire Hills district centering in Pittsfield, Mass., but the costs presented herewith cover only those lines completed and in operation in the Connecticut Valley. Through the courtesy of the company the photographs accompanying the data printed here have been furnished to give the reader an idea of the types of construction adopted in the development of the system. The first line was built during 1910 to furnish a connection between Turners Falls and the Mount Tom steam plant via Amherst, the line between Turners Falls and Amherst at that time being a 22,000-volt wooden-pole line. This new line was built for 66,000 volts, but was operated until 1913 at 22,000 volts. The primary cause for its construction was a mill load in Easthampton, near Mount Tom. The second line was built between Turners Falls and Springfield in 1912 and 1913, the Springfield district being the only available market at the time for the sale of the output of the company's No. 1 plant in Turners Falls. The third line was built between Turners Falls and Amherst in 1916 by the company. This line was constructed as a first step toward furnishing transmission capacity equal to the entire hydro-electric development. This line was originally built with two circuits to Leverett (the point of interconnection with the New England Power Company) and one from there to Amherst, but had



LINE DIAGRAM OF TURNERS FALLS POWER & ELECTRIC COMPANY, SHOWING LOCATION OF LINES (NOT TO SCALE)





LEFT—A RIVER-CROSSING TOWER ON THE AMHERST-SPRINGFIELD LINE. CENTER—A DOUBLE-CIRCUIT RIVER-CROSSING TOWER IN SPRINGFIELD. RIGHT—TOWER RAISED ON CONCRETE PIERS ON A RAILROAD CROSSING ON THE CHICOPEE-SPRINGFIELD LINE

hardly been put into operation before load conditions warranted the completion of the other circuit, as well as the addition of one circuit from Granby to Mount Tom, this circuit being tapped off the Turners-Springfield line at Granby.

The fourth line was built between Amherst and Granby by the company in 1917, one circuit being run at that time. The load in the Springfield district had by this time increased sufficiently to require improved regulation, and this circuit relieved the load carried by the Granby-Mount Tom line from the Turners-Springfield line south of Amherst.

Soon after the completion of this line negotiations were under way to care for the Springfield Street Railway Company's load, which required additional circuits from Amherst to Springfield. Estimates from surveys showed that a line built by way of Westfield to Agawam would not call for a greater investment than to build over the right-of-way already owned by way of Chicopee, and the fact that a line via Westfield gave a complete loop system from Amherst, together with the advantages of having a 66,000-volt line into the Westfield section, made this routing much more desirable.

The section from Mount Tom to Westfield and Agawam was started in 1917, and at the same time an additional circuit was added from Amherst to Granby and from Granby to Mount Tom. During 1917-1918 an extension was built from the Turners-Springfield line between Agawam and Springfield to the Margaret Street Station of the Springfield street railway; also, a tap from the Turners-Springfield line in Chicopee was made to the Hampden Steam Plant.

The line between Turners Falls and Amherst consists of a single line of towers with two circuits of No. 1/0 seven-strand copper and one $\frac{3}{8}$-in. seven-strand galvanized-iron ground wire. The towers are four-post galvanized-steel Millikens, 75 ft. 6 in. in height, with a spread at the base of approximately 17 ft. The cross-arms are spaced vertically 10 ft.

The line between Turners Falls and Amherst consists of the same general type of towers as the above

TABLE I—GENERAL DATA ON TRANSMISSION LINES

	Turners Falls-Springfield	Mount Tom via Mill Valley	Mount Tom via Granby	Agawam via Mount Tom
Rights-of-Way:				
Length of right-of way, miles	43.7	8.04	5.78	21
Amount taken in easements, miles	40.4	7.79	5.78	20.24
Total easements taken	254	71	45	177
Amount taken in purchase, miles	3.3	0.25	0	0.76
Total parcels purchased	21	0	0	29
Amount previously owned by company, miles	1.1	0	0	0
Width of right-of-way, ft.	150	0	100	100
Number of acres land purchased	66.27	0.75	0	9
Distance on Line:				
Building lots, miles	4.9	0	0	1.2
Cultivated land, miles	7.2	4.8	2.4	5.42
Pasture and brush, miles	18.4	1.84	5.3	13.6
Timber, miles	2.4	0	1.9	.6
Meadow, miles	10.8	1.4	2.0	0.18
Number of tower lines	2	1	1	1
Standard Construction:				
Number of miles standard construction	67.82	8.04	5.78	21
Number of towers	683	93*	42	193
Number of straight-line towers	485	89	31	135
Number of dead-end towers	198	4	11	58
Number of railroad-crossing towers	22	1	1	6
Number of river-crossing towers	7	2	2	2
Height of standard tower, ft.	72.5 and 75.5	54	73	73.9
Area at base, ft.	16.05 and 17	12	17	17
Spacing between cross-arms	9 and 10	6	10	8
Excavation and Setting:				
Number of earth footings	407	80	16	180
Number of rock footings	80	0	16	0
Number of combination footings, earth and rock	70	0	4	1
Number of swamp footings	30	0	0	0
Number of footings in concrete	96	16	6	12
Size of transmission wire	†	No. 2	No. 1/0	No. 1/0
Number of wires to tower	6	3	6	6
Size of ground wire	3/16-in.	3/8-in.	7/16-in.	$\frac{1}{4}$ in.
Size of telephone wire	No. 6 iron	$\frac{1}{4}$-in. iron	0	$\frac{1}{4}$-in. iron
Number of telephone wires	2	2	0	2
Manufacturer of tower	Milliken	U. S. W. E. & Pump Co.	Aermotor	Downing Ship Co

* Eleven Milliken towers. † 100.6 miles No. 1/0, 35.04 miles No. 2/0.

TABLE II—SUMMARY OF TRANSMISSION-LINE COSTS

	Turners Falls-Springfield	Mount Tom via Mill Valley	Mount Tom via Granby	Agawam via Mount Tom	Total
Land	$40,916.17	$417.77	None	$16,781.96	$58,115.90
Easements	258,515.30	12,931.52	9,987.94	89,318.96	370,753.72
Tower lines	791,128.72	60,812.70	69,893.13	432,508.58	1,354,343.13
Total	$1,090,560.19	$74,161.99	$79,881.07	$538,609.50	$1,783,212.75

TABLE III—COST DATA ON TRANSMISSION LINES

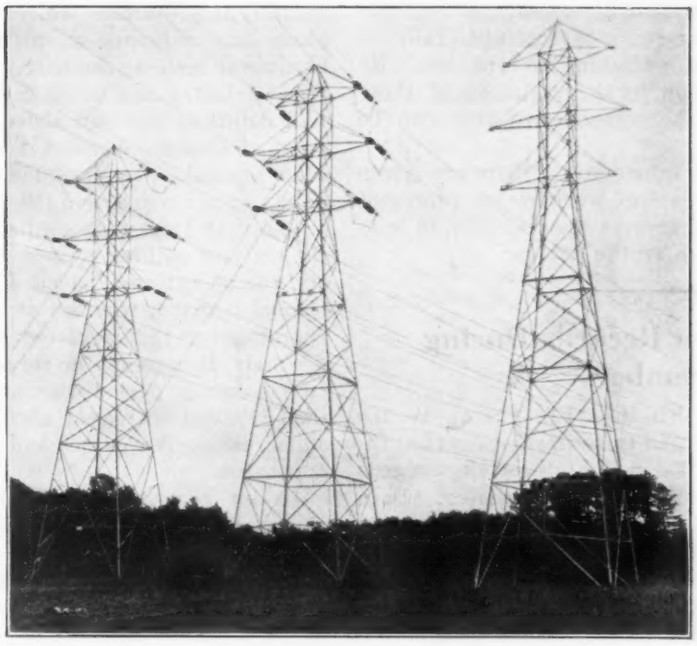
	Turners Falls-Springfield	Mount Tom via Mill Valley	Mount Tom via Granby	Agawam via Mount Tom
Rights-of-Way				
Cost of easements	$258,515.30	$12,931.52	$9,987.94	$89,318.96
Cost of land purchased	40,916.17	417.77	None	16,781.96
Cost per mile of easements	5,915.68	1,608.40	1,728.02	4,253.28
Cost per mile of land	936.30	52.20	.....	799.14
Cost per acre of land	617.41	556.04	.....	1,864.66
Average cost per easement	1,017.00	182.13	221.93	504.62
Average cost per parcel of land	1,948.39	417.77	.....	578.69
Number of tower lines allowed for	Two	One	One	One
Total cost of standard construction	$607,359.34	$60,812.70	$43,232.39	$268,150.76
Coast per mile standard construction	8,955.46	7,563.77	7,479.65	12,769.08
Cost per mile of material	5,874.68		4,887.56	8,238.26
Cost per mile of labor and transportation	2,401.53		1,993.72	3,317.76
Rate of labor wage	2.25		2.50	4.00
Cost of engineering and supervision	626.16		598.37	1,213.06
Cost per Mile of Material:				
Towers	1,739.43		1,457.76	2,909.04
Copper	3,014.39		2,652.12	3,570.16
Ground wire	116.86		130.37	149.78
Telephone	235.06		None	640.86
Insulators and hardware	768.94		647.31	968.42
Cost per Mile of Labor and Transportation:		(See Note)		
Clearing	302.17		501.87	381.24
Footings	369.81		269.20	578.65
Erection	373.44		403.50	420.17
Installing wire and insulators	363.92		374.36	494.13
General items*	992.19		444.79	1,443.57
Special Construction:				
Total cost of special construction	$183,769.38		$26,660.74	$164,357.82
Total cost of railroad towers	21,727.64		891.25	3,892.43
Total cost of river towers	110,620.00		17,903.09	50,896.99
Total cost of special footings	51,421.74	(See Note)	7,866.40	109,568.40
Cost per railroad-crossing tower, including footing	987.62		891.25	1,946.22
Cost per river crossing, complete	27,655.00		.....	25,448.48
Cost per yard, special footings	38.58		30.55	46.15
Summary of Lines:				
Standard	$607,359.34	$60,812.70	$43,232.39	$268,150.76
Special	183,769.38	.....	26,660.74	164,357.82
Total	$791,128.72	$60,812.70	$69,893.13	$432,508.58

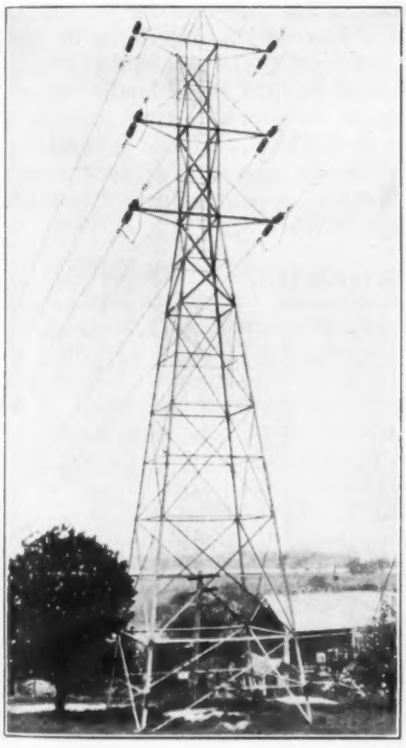
* General items: general foreman, preliminary work, permits, interest, insurance and taxes, dead time, stock clerks, field office, timekeepers, stock sheds, blacksmith shops, accidents, repair of fences, cleaning up, making topographic maps, guying, reports, inspection, excess freight and express, danger signs.

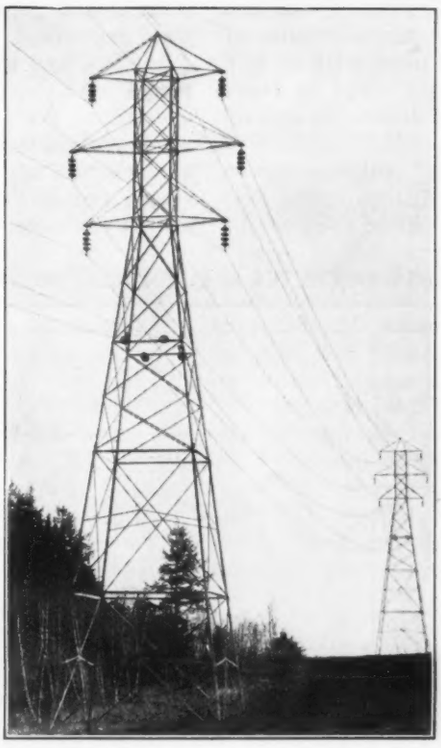
Note:—Both special and standard construction included in standard construction figures on the Amherst-Mount Tom line. This line was constructed before the present organization had anything to do with this system, so no records are available for detail costs.

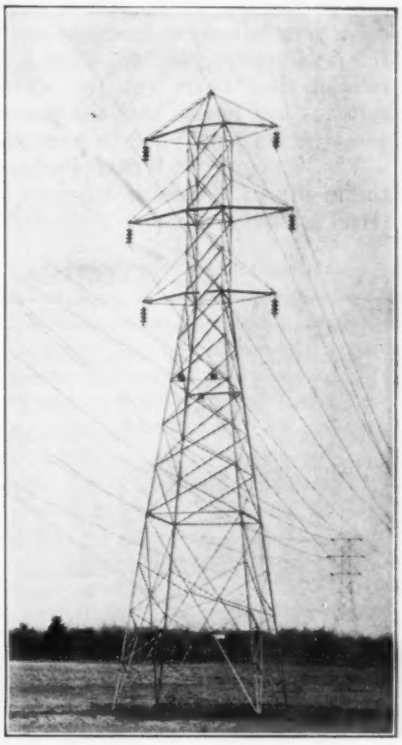
line, with two circuits of No. 2/0 seven-strand copper wire and ⅜-in. seven-strand galvanized-iron ground wire and two ¼-in. seven-strand galvanized-iron telephone wires.

The line between Amherst and Springfield is built of Milliken four-post galvanized-steel towers, similar in design to the above, but with an arm spacing of 9 ft. and a total height over all of 72 ft. 6 in., with a spread at the base of approximately 16 ft. 6 in. On this line are three river crossings. These towers were designed by J. R. Worcester & Company, Boston, and were furnished and erected by the Eastern Bridge & Structural Company, Worcester, Mass.









TYPES OF TOWERS USED IN LINE CONSTRUCTION

Top—Standard construction on the Mount Tom-Agawam Line. Left—"Aërmotor" towers are used on the Springfield-Mount Tom line via Granby. Center—Towers on the southgoing lines from Amherst. Right—Standard towers on the Turners Falls-Amherst lines.

The line via Mill Valley between Amherst and Mount Tom consists of a single line of single-circuit, galvanized-steel four-post towers furnished by the U. S. Wind Engine & Pump Company, and it carries three No. 2 seven-strand copper wires, one ⅜-in. seven-strand galvanized-iron ground wire and two ¼-in. seven-strand galvanized-iron telephone wires. In this line there is also a river crossing, built of special towers designed and furnished by the U. S. Wind Engine & Pump Company. The line between Amherst and Agawam consists principally of Milliken standard four-post 75-ft. 6-in. galvanized-iron towers. There is a section along the south side of the Holyoke Range which is built of four-post "Aërmotor" towers, the general dimensions of which are the same as those of the Milliken type. On this line is considerable special construction through what is known as "Hockanum Meadows," as well as river crossings.

As a help to explaining the variation in the costs of different types of line, the company has tabulated the amount of each kind of land through which it was necessary to purchase a right-of-way. This to some extent should explain the difference in cost between two rights-of-way, but the human element and the fact that rights for other lines may have been purchased in the same vicinity are more important factors, perhaps, than the actual value of the land itself.

In construction work the company was able to arrive at closer units of cost, the important factors in comparison being unit costs of material, rate of wages, type of digging, accessibility to line, proximity of freight yards to line, contour of land, amount of timber to be cut, time of year construction was carried on, size

of transmission wire, labor-housing conditions and special construction, such as concrete footings, railroad crossings, river crossings, switching towers, etc. By giving careful consideration to the variation of these items in different lines the comparative cost can be accurately determined.

As a matter of general information, there are given in Table III a few unit costs of work which represent a fair average of cost of several lines similar in construction to those covered by the tables.

New Production Records During December

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that new high activity records were set within the industry during December. Data issued by the Department of Commerce indicate that a new record since 1920 was established in pig-iron production, an industry which is regarded by many prominent economists and statisticians as the best barometer of general business conditions. Other outstanding activities during December were a larger output of coal and coke, very heavy car loadings and the largest volume of retail sales ever recorded. The large production of fabricated steel bears out the statement made in these columns last month that the seasonal decline in general construction had failed to materialize.

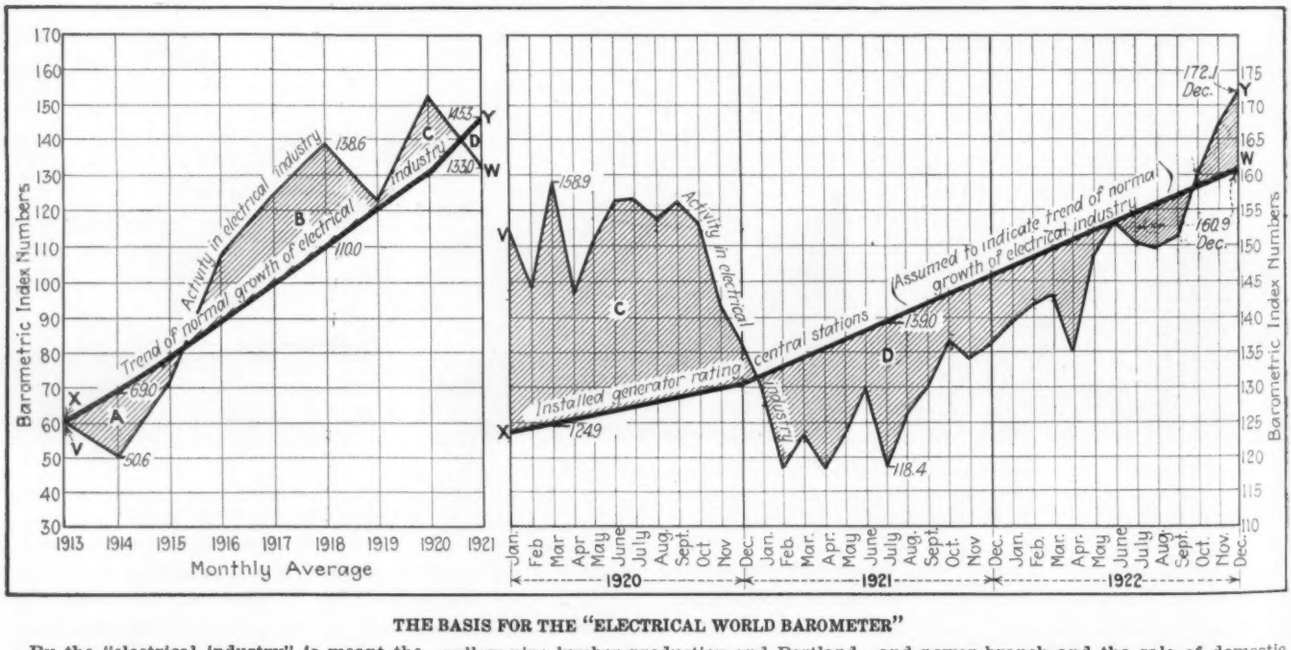
The "ELECTRICAL WORLD Barometer" indicates that in the month of December business conditions in the electrical industry, taken as a whole, continued to show the monthly improvement which started in September. The basic data indicates an increase of 5.0 points on the barometer scale as compared with November. The electrical industry as a whole in December was operating at 11.2 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In November it was operating at 7.7 points or per cent above the point of normal demand.

The year 1922 witnessed some remarkable changes in the activity within the industry. In January the industry was operating at about 8 per cent below the point of normal demand, whereas at the end of the year it was operating at 11.2 per cent above the point of normal demand. It must not be forgotten, also, that during this twelve-month period the normal productivity of the industry had increased about 10 per cent in order to supply the increased demand for energy, machinery and apparatus.

In its review of general business conditions the Harvard University Committee on Economic Research has the following to say:

"The business improvement inaugurated early in 1922 continued during the last month of the year. The rise of the business curve of our index chart has been substantial and persistent. The maintenance of this upward movement has evidenced the soundness of basic conditions and the strength of the favorable economic forces. At the opening of 1923 these forces are still operative. We forecast, therefore, further increase of wholesale commodity prices and continued expansion of business activity during the first half of 1923, with a strong probability that the upward swing will continue during the second half of the year."

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



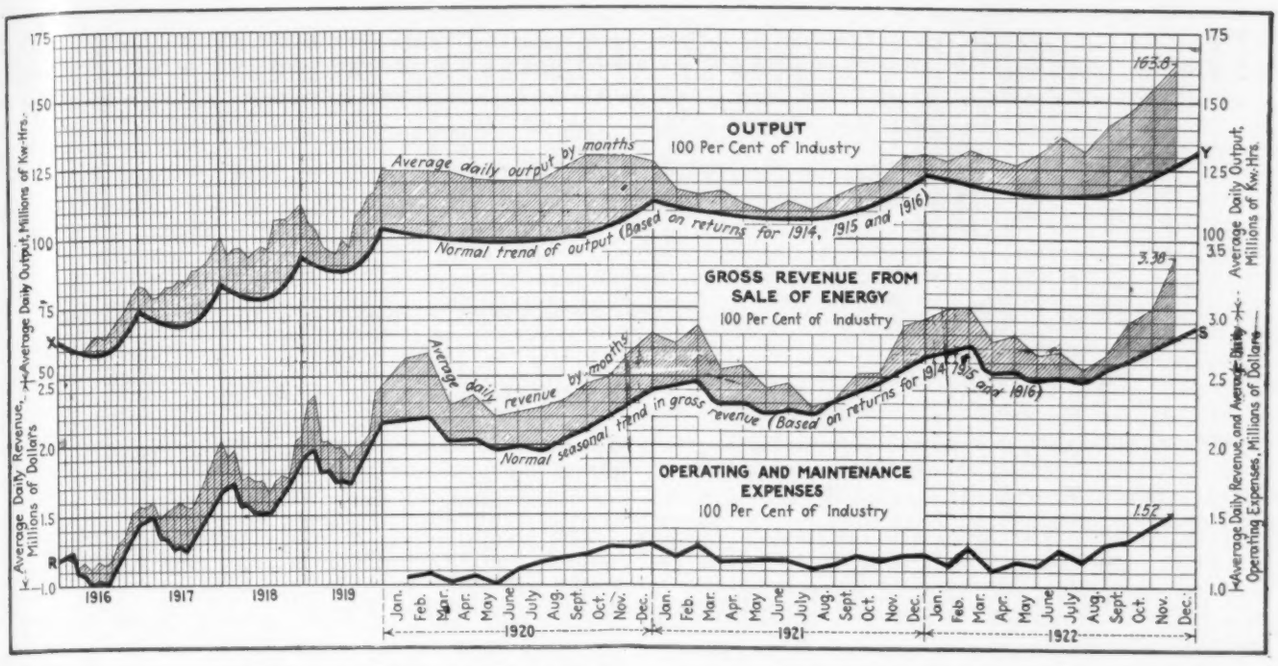
THE BASIS FOR THE "ELECTRICAL WORLD BAROMETER"

By the "electrical industry" is meant the electric light and power branch, the electrical manufacturing branch and the electrical merchandising branch, taken as a group. The chart is not believed to be barometric for these branches as units.

By reason of their large influence on activity within the electrical industry the following nine primary industries have been adopted as a basis for the "activity curve" of the electrical industry: Active cotton spindles, pig-iron production, bituminous-coal production, copper production, newsprint-paper production, passenger automobile production, truck automobile production, yellow-pine lumber production and Portland cement production.

Activity in each of these basic industries referred to its own normal growth curve is found, and then this index of activity is applied to the electrical industry in proportion to the influence of the particular basic industry on the electrical industry. The estimated horsepower of the motors installed in the plants of the various basic industries has been taken as a basis for weighting the industries in their influence on the electrical industry. In weighting the lumber and Portland cement industries the large domestic load of the electric light and power branch and the sale of domestic apparatus have been taken into consideration. Applying these weights to the activity in each basic industry, adding the totals and dividing by the total of the weights gives the activity in the electrical industry referred to the "trend of normal growth of the electrical industry."

The line showing the "trend of normal growth of the electrical industry" is based upon the rating of the active installed generators of the central stations of the country. Further details concerning the development of the "Barometer" will be gladly furnished upon request.


OUTPUT
100 Per Cent of Industry
Average daily output by months
Normal trend of output (Based on returns for 1914, 1915 and 1916)
163.8
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily revenue by months
Normal seasonal trend in gross revenue (Based on returns for 1914, 1915 and 1916)
3.38
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
1.52
Average Daily Output, Millions of Kw.-Hrs.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1916
1917
1918
1919
1920
1921
1922

Record Output and Revenue in November

Output for November Totaled 4,915,000,000 Kw.-Hr., an Increase of 23.1 per Cent for the Twelvemonth Period—Average Daily Revenue Exceeded $100,000,000

FOUR new records were hung up by the electric light and power industry during November. Reports for the month received by the ELECTRICAL WORLD for electric generating and distributing companies representing 81 per cent of the installed generator rating of the country indicate that the average daily output was 163,813,000 kw.-hr. This exceeded the previous record made during October by 9,323,000 kw.-hr. In addition, the total output for the month of November was 4,915,000,000 kw.-hr., which exceeded the former high monthly figure set during October by 130,000,000 kw.-hr. and the output reported for November, 1921, by 23.1 per cent. The second set of record figures reported by the industry for the month of November is to be found in the revenue received from the sale of energy. The average daily revenue from the sale of energy during November was $3,380,000, which exceeded the previous record, made during February, 1922, by $353,000. In addition, for the first time in the history of the industry the total gross revenue for the month exceeded one hundred million dollars, the exact figures being $101,400,000, which exceeds the previous record, made during October, 1922, by $8,100,000.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to the gross revenue from the sale of energy, shows that financially the industry is very close to the position it occupied this time last year. The operating ratio reported for November by companies having steam plants only, taken in the aggregate, was 50.4 per cent against 50.2 per cent for November of last year. It is encouraging to notice that the operating ratio has decreased from 56.6 per cent in August, or by about 6.2 per cent. Such a decrease in the operating ratio between winter and summer months is to be expected, however, on account of the relatively higher percentage of low-revenue industrial energy sold during the summer months. During the past fall this was overcome to some degree by the higher price of coal subsequent to the strike. If the normal trend of past years is followed, the operating ratio should continue to decrease and the lowest point should be reached during December or January, when the high revenue load is at its peak. However, if the price of coal decreases in the spring, it may be that the operating ratio will decrease further, notwithstanding the curtailment in domestic lighting requirements which occurs as summer approaches.

A final government report indicates general advances

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1922 Thousands	1921 Thousands	Per Cent Increase
Sept..	83	3,647,228	2,987,072	22.0	76	$66,435	$57,977	14.6
Oct...	82	3,927,193	3,183,173	23.4	76	70,886	61,039	16.1
Nov..	81	3,980,691	3,232,200	23.1	75	76,051	65,268	16.5

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1922	Steam Plants 1921	Hydro Plants 1922	Hydro Plants 1921	Combined Systems of Steam and Hydro 1922	Combined Systems of Steam and Hydro 1921
Sept..	62	24,559	22,353	9.8	53.4	53.2	26.4	25.8	46.9	48.3
Oct...	62	27,710	23,260	19.2	52.1	51.1	28.9	27.8	48.8	47.7
Nov..	62	28,225	26,028	8.4	50.4	50.2	24.3	25.0	46.0	45.2

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
Sept.	81	261,523	225,408	16.1	82	1,307,413	1,037,644	26.0	81	1,170,148	976,556	19.7	64	194,866	158,373	23.0	97	713,248	589,091	21.0
Oct.	80	297,362	251,833	14.1	80	1,408,383	1,132,485	24.3	82	1,306,654	1,059,771	23.3	64	196,846	160,283	22.8	97	715,356	578,801	23.7
Nov.	78	313,057	248,472	26.0	78	1,443,083	1,167,993	23.6	81	1,327,148	1,079,325	23.1	64	209,918	161,865	29.7	97	687,485	574,545	19.7
REVENUE:																				
Sept.	81	$6,335	$5,754	10.1	76	$24,478	$20,973	16.7	68	$20,516	$17,592	16.6	64	$4,495	$4,029	11.5	97	$10,612	$9,629	10.2
Oct.	80	7,055	6,370	10.7	74	26,437	22,468	17.6	69	22,112	18,704	18.2	64	4,683	4,099	14.3	97	10,599	9,398	12.8
Nov.	78	7,760	6,882	12.7	73	28,707	24,363	17.8	69	23,542	20,046	17.4	62	5,111	4,333	17.9	96	10,931	9,644	13.4
OPERATING EXPENSES:																				
Sept.	53	$2,029	$2,091	−2.9	56	$7,640	$7,357	3.8	55	$8,924	$7,295	22.4	63	$2,300	$2,046	12.4	96	$3,666	$3,564	2.9
Oct.	52	2,387	2,023	17.9	55	9,172	7,681	19.4	54	10,625	8,586	23.7	63	2,383	2,094	13.8	95	3,700	3,409	8.6
Nov.	52	2,546	2,160	17.8	54	8,928	7,752	15.2	57	10,556	8,456	24.6	62	2,521	2,189	15.1	94	3,674	3,550	3.5

in production, transportation and distribution during November. One of the outstanding facts is that the usual seasonal decline in building contracts failed to materialize in November. Expansion of employment throughout the nation was the greatest since January, large gains being reported in the iron and steel industry, tobacco, textiles, and metal products other than iron and steel. These favorable industrial data, taken in conjunction with the fact that the advancing season called for largely increased consumption of electrical energy for electric lighting purposes, explains very clearly the record figures quoted above.

Every section of the country except the Mountain and Pacific States reported material gains in output over October. The largest gain was reported from the Atlantic States. The slight decrease reported by the Mountain and Pacific States was undoubtedly due to the decrease of irrigation requirements with the advancing season.

Hydro-Electric Plant Within the Arctic Circle

THE unusual size of generating sets used in the Norwegian state power house on the Glomfjord, 30 miles above the Arctic circle, together with a number of unique features of the general station layout, attract considerable interest. According to G. Troeltsch in the *Elektrotechnische Zeitschrift*,* this development has a watershed of 96 square miles, yielding on an average 88 cu.ft. of water per second. Several large lakes into which a group of glaciers discharge serve as a natural water-storage reservoir, totaling 18,356,000,000 cu.ft., or about 70 per cent of the yearly water flow. A 9,050-ft. pressure tunnel of 192-sq.ft. cross-section delivers the water to the collecting bay, from which two high-pressure penstocks lead down to the power house at the seacoast, representing a head of 1,542 ft. These pipe lines taper from 6½ ft. top diameter to 4.6 ft. at the lower end. They are built up of welded-steel pipe lengths riveted together. For topographical reasons it was necessary to lay about two-thirds of the penstock in one direction and the rest of it at an angle of almost 90 deg. to the first run. At the upper end of each of the penstocks three independently operating closing gates are installed to minimize the danger of flooding the power house in case of failure of the pipe lines.

*E. T. Z., Nov. 9 and 23, 1922.

The foundation of the power house provides for six sets of turbines, but the present superstructure will house only four. The turbines are of the Pelton double-runner type, built by Voith, with a rating of 25,000 hp. for two of the units and 27,500 hp. for the third, all to operate at 300 r.p.m. The runners of the larger unit measure 11 ft. in diameter and have each twenty buckets 2 ft. in width. The waterwheel rotor weighs complete with the shaft 35 tons. The water jets from the two nozzles are 10 in. in diameter. Double regulation with needle and jet deflectors is provided, being operated by a double-piston "servo-motor," for which the pressure is derived from two independent sources. One oil pump is belted to the main turbine shaft, and a second pump is driven by a small Pelton wheel. Tests made on the turbine at the power house showed a highest efficiency of 88.2 per cent and an increase in speed of 8.8 per cent when a load of 23,000 hp. was disconnected.

The direct-coupled three-phase generators, built by the Almänna Svenska, are rated for 20,000 kva. at 80 per cent power factor, 25 cycles, 15,000 volts and 300 r.p.m., but are guaranteed to withstand a permanent overload of 2,000 kva. The machines are completely inclosed and are ventilated by two fans made of fins attached to each end of the rotor. The over-all diameter of the large generator is 22 ft. The complete machine weighs 225 tons, of which 95 tons are rotating.

The entire stator rests on a number of rollers in the bottom of the generator pit, so that in case a coil section burns out in the lower part of the stator that part can be turned upward for easy repair. The rotor is built up of six steel disks, to which are fastened ten poles. The main generator bearings are water-cooled. To each of the three bearings of a set a small hand pump is connected to force oil under the heavy shaft of the machine before it is started. An exciter is directly connected to the generator shaft.

As the center of energy consumption is only about three miles from the power house, the 15,000-volt generator voltage is used directly as transmission voltage. Two three-phase lines of 240-sq.mm. copper carry the entire output of the power house. For a distance of 1 mile they run through a tunnel along the seacoast, and then outdoors for 2 miles more on very attractively built reinforced-concrete towers.

The cost of constructing this station with its present capacity of 77,500 hp. was $5,600,000, or $72.50 per installed horsepower.

Keep Public Contacts from Sparking—III

A Few More Suggestions Pointing to Opportunities Where Central-Station Executives May Develop Policies that Will Prevent Small Points of Friction and Improve the Standard of the Public Service

By E. L. MILLIKEN
Stone & Webster Management Division
Assistant Manager Blackstone Valley Gas & Electric Company, Woonsocket, R. I.

MUCH has been written of late on the subject of educating certain classes of central-station employees who are in particularly close touch with the consumer. Less stress has been laid on the importance of the managers and executives of companies setting an example for these employees, not only in their own dealings with the public, but in their relations with the employees.

The force of a good example is just as much needed in our public relations work as it is in any other phase of human endeavor. Proper and courteous treatment of employees by company officials is bound to be reflected in similar treatment of the public by these employees. The pyramid is not complete unless there is an apex as well as a base. As a matter of fact, the relation of most employees to the management and executive staff is a dual one. They are consumers as well as employees, and as today, under state regulation, they rarely receive preferential rates, their status as consumers is on a par with that of all other consumers. So proper public relations, like charity, must begin at home. This thought is stressed in order that the points in the following paragraphs may be understood to apply to the entire organization of a public utility.

Employees' Attitude When Buying in Local Stores—Purchasing from local merchants by employees may well be fostered in an unobtrusive, diplomatic way. Local merchants, particularly in the smaller cities and towns, feel that they are entitled to at least a fair portion of the trade of the employees of the local central station.

Encourage Employee Buying

The official family of a utility may help wonderfully in this respect. Yet the good may be nullified if they make deprecatory statements as to a merchant's goods or compare his prices with what they can get elsewhere. They do not have to buy from him if they do not so choose, neither do such complaints ever help them, and their attitude many times reflects unfavorably on public sentiment regarding the company.

Family Affairs—The attitude of the family of a central-station official, and especially of a manager, may do much harm to the company. His wife or his children may offset all that he may do to improve his company's standing in a community. His happy relations with the men of the community may be brought to naught or diminished in value if his family, working through their families, creates a negative impression.

General Social and Business Intercourse—Seldom does a central-station official make an enemy without that enemy some day being in a position where he can refuse to do the company a favor or give it additional business. The converse is true as regards making friends. The pigeons always come home to roost.

A central-station manager particularly cannot afford outwardly at least to condemn, disparage or discredit any person or movement. On the other hand, he can well afford to boost each and every legitimate civic movement and praise and make friends with every citizen. The dollar of the central station's income knows no sex, no creed, no nationality and no political faith.

Passive Resentment—We have heard much of the "passive resistance" policy of the followers of Gandhi in India. From this we may well learn a lesson. The central-station company which becomes lulled into complacency because of lack of complaints may well become suspicious. No matter how good the service rendered, there is always an underlying sentiment in the community which, for lack of a better term, we will call "passive resentment." This is antagonism to the company unexpressed either to it or even to other consumers. It is the nursing of grudges many times of long standing. Its particular danger lies in the fact that those consumers who entertain the feeling have been unable to get satisfaction from the company and have given up in disgust. This sentiment can only be unearthed by a constant broadening of the service policy and by having company officials and employees keep their ears close to the ground.

Women Can Create Favorable Sentiment

The "greater service" policy of the Southern California Edison Company points one way in which such sentiment can be reached and negatived. Another way is for the central station to send around women to do house-to-house repair service. Possibly in this latter way, on account of using woman representatives, more complete information is acquired about passive resentment. These women seem to get closer to the housewife, and she tells them more freely her troubles. The sentiment of business men and all civic bodies may be favorable to a company, but that company is not strong in the community unless the sentiment in the homes of its consumers is likewise favorable.

Studying Buying Impulses—In order best to understand the public we serve and to increase our gross earnings to the maximum possible, we should study the impulses which prompt people to buy various classes of commodities, including our own service. After having become familiar with these we should, so far as possible, cater to them.

Too often we take it for granted that all people are convinced of the need for our service. This is not true, and there is a large portion of the public who have yet to be shown wherein our service can benefit them. We should find out what it is that people want in the line of service and then try to show them wherein our own service supplies their wants.

Various statements have been made in recent months commenting on the number of people who have bought automobiles as compared with the ones who have had their homes wired. Not much effort seems to have been made to fathom why a given family makes various sacrifices in order to buy and run an automobile. By studying this question it is very possible that we shall be able to produce arguments which we can use to induce people to make a somewhat smaller sacrifice than is required to buy an automobile and have their homes wired.

Study Mercantile Practices—The writer not long ago sat in a store sipping one of those concoctions made popular by the Eighteenth Amendment. The proprietor of this particular store had a reputation not altogether to be envied as regards his relations with other men, yet his business was prosperous and growing. Observation at the time showed that whatever his qualities were which resulted in lack of favor in the eyes of his fellow business men these qualities did not enter into his relations with his customers. His clerks were uniformly attentive and courteous to each and every customer, regardless of his or her station. The proprietor was at the front of the store, and while he did not make sales directly he had a pleasant word for nearly all his customers before they left.

STUDY BUSINESS METHODS OF SMALL DEALERS

This experience, so opposite from what had been expected, caused me to wonder if we could not profit in our industry by actually studying the business methods of the successful small retailer. As far as residential lighting is concerned, the central station is a retailer, and it is only the nature of the business, the great need for and value of the commodity sold—gas or electric service—that results in an unusually large number of consumers and makes the central station a larger industry than the small retailer.

The relations with the individual consumer are, or at least should be, no different from those of the grocer, the baker or the shoe dealer. Therefore study of the business methods of the small stores should be productive of good, if but to show in some instances things not to be done.

Advising Customers Regarding Appliances—The natural zeal which all good salesmen show in selling lighting or heating appliances sometimes leads to strained relations with purchasers. This is more particularly true of those appliances which are naturally large consumers. The indiscriminate sale of room heaters or hot-water heaters is decidedly inadvisable. In the case of hot-water heaters, particularly of the automatic type, not alone is the first cost of the appliance considerable, but likewise the increase in the customer's bill. Unless he is thoroughly advised as to the cost of operating the appliance, it will invariably give rise to complaint on his part.

Many times this results in the company having to take back the appliance, but it cannot take back—and in fact it is very difficult to overcome—the distrust engendered in the customer's mind by the whole transaction. It would be better not to sell such appliances than to have this result.

Salesmen should be made to understand that the sale of an appliance by the company is not completed with his making out the order for delivery or with the customer's payment in full for the appliance. They should be educated to the point of view that the appliance is only finally sold when the customer is satisfied with the service which the appliance renders and with the expense to him of such service.

There is only one way to forestall conditions arising such as those above outlined, and that is a careful study on the part of the sales organization of the adaptation of the various types of the more expensively operated appliances to the needs of the various classes of customers. The sales department must know all of the characteristics of these various types and the cost to operate under various conditions. Then only are the salesmen properly equipped to sell these appliances in such a manner that they will stay sold.

Instruction in the Schools—We all know the difficulty of educating the present generation to an understanding of the gas or electric meter. There is no excuse, however, for permitting the next generation to be unfamiliar with the principles of the meters and how to read them. This is best accomplished through the physics classes in the high schools. Some of the modern physics textbooks already devote some space to the reading of meter dials, and some even go so far as to illustrate the meters.

The trend of modern physics instruction seems to be towards practicability, and most instructors on the subject will be only too glad to have presented to their laboratories some modern house meters with glass cases. If they are properly approached, the chances are that they will allow the company to send a representative to talk to the physics classes on the construction and reading of meters whenever this subject is reached in the courses. In this way the consumers of tomorrow can be made to understand the accuracy of the meter and learn how to read it.

What is true of meters is likewise true of domestic appliances. The central station in any territory may well make it a point to see that the domestic science laboratories in the schools in its territory are equipped with standard gas and electric appliances, such as electric ranges, vacuum cleaners, electric flatirons and washing machines. There would seem to be no better place to teach the housewives of tomorrow the benefits of gas or electric service than at that formative period of life when they are receiving instruction in the public schools.

HELP SCHOOL COURSES

The study of optics, which comes under the general consideration given to "light" in the physics courses, offers another field for valuable work in the schools. Hitherto considerable time has been spent on the study of various optical problems which the student rarely encounters in his every-day life after leaving school. If a presentation is made to the school laboratories of some of the new portable luminometers, the physics instructors, when they come to the subject of "light," will have the means of teaching their students practical illumination problems. If we can by this means bring before the children of the country the importance of proper and scientific illumination in the schools, in their homes and in factories, the entire plane of artificial illumination will be raised, with a very evident favorable effect on the electric lighting industry.

Telling the Story—In their efforts to improve public and consumer relations, there is nothing to be gained by central stations "hiding their light under a bushel," and there is everything to lose. Advise the public

when you cut out application cards, when you adopt a liberal policy as regards rebates, when you instruct your employees on this and that movement to better the service. The public will respond and assist your employees in carrying out this policy.

Giving Credit Where Credit Is Due—To give to an employee or group of employees credit for some particular accomplishment in connection with the company's business has a very favorable effect on public sentiment. Such action on the part of the executives of the company always becomes known in the community eventually. The organization which has the reputation of giving credit where credit is due is bound to stand in a favorable light. The effect is favorable primarily on the employees, because they feel that those higher up along the line are watching their efforts.

There is nothing new in these paragraphs. The conditions of which they treat have existed since the earliest days of the industry. In some instances remedies have been applied, and in others it yet remains for them to be applied. The instances quoted are not theoretical, but are the results of actual experience and observation. The remedies suggested have proved successful in attaining the ends sought.

Lamp-Socket Standardization

International Agreement on Receptacle Dimensions Takes Precedence Over Lamp-Base Gage—Conference of Manufacturers to Be Called

AS PUBLISHED in the ELECTRICAL WORLD of Dec. 2, the International Electrotechnical Commission met at Geneva, Switzerland, Nov. 20-25. Among the subjects taken up for consideration was the standardization of lamp bases and sockets. Delegates from France, Holland, Germany, Great Britain, the United States and Italy came prepared for action on the matter and as a result of their deliberations it can be confidently said that international agreement on lamp and socket dimensions is fairly well assured.

The printed report of the lamp committee of the Association of Edison Illuminating Companies and the sub-committee of the standardization committee of the American Institute of Electrical Engineers showed that the Americans had delved more deeply and exhaustively into the subject than any of the other delegates, and for that reason the fundamental facts in their report served as the basis of the discussion. At the outset it was agreed to consider only standard lamps with screw bases, leaving candelabra and miniature lamps as well as lamps with bayonet bases to come up for discussion and action at some other time. It developed that the screw base is used all over the world except in France, England and certain French and English colonies, where lamps with bayonet bases predominate.

The main general question considered at a preliminary meeting on Nov. 24 was whether to standardize the lamp base first or the lamp socket. The English delegates were inclined to favor the former, while the American delegates favored the latter and in this were suported by the Germans. The reason advanced was that the socket is the permanent or long-lived investment and piece of apparatus, so that it was logical to make that part of the combination standard and uniform, after which lamp-base standardization would immediately and automatically follow.

The chief difference between American and European practice rests in the depth of thread, the German lamp possessing a deeper thread than the American lamp. It was explained by the German delegates that a deeper thread was resorted to in order to eliminate trouble which had been experienced from lamps falling out of sockets. While incandescent electric lamp manufacture in Europe is concentrated in the hands of a few manufacturers, sockets and receptacles are made in many small factories and machine shops without standard gages, dies or jigs, so that the sockets are not so uniform as the lamps. German manufacturers of lamps had hoped that by deepening the lamp thread they would force the adoption of a deeper thread in the sockets.

AMERICA FAVORS SOCKET STANDARDIZATION

At the formal meeting of the committee it was proposed by the American delegates that an effort be made to standardize a universal socket which the data at hand indicated would be substantially of the same dimensions as the standard American socket. There was some discussion over the name to be given this standard, objection being made to the use of the word "American." The words "universal" and "Edison" were proposed as alternatives, but no formal recommendation was made. The European makers expressed themselves as being willing to adopt and use the American socket as standard if it could be demonstrated that in practice there is no possibility of trouble in regard to the fit of the European-base lamp in the socket.

Inasmuch as some of the delegates could not commit themselves to any fixed set of dimensions without consultation with manufacturers of the metal parts, definite action could not be taken at that time. An agreement was reached, however, on the following points:

1. That effort should be concentrated on the standardization of a universal type of socket.

2. That through the good offices of representatives of the manufacturers present the questions of fact which had been raised at the meeting shall be subjected to inquiry by a group of manufacturing experts of interested countries, and that this group shall meet in Europe for the purpose of discussing the actual manufacturing dimensions and tolerances which are requisite in such a universal socket.

3. That this group of manufacturing experts shall report its findings to the national committees represented at the meeting and to the central office of the I. E. C. for general distribution.

4. That subsequently a meeting of this I. E. C. advisory committee shall be called, preferably about the middle of 1923, the time and place to be at the discretion of the central office. The suggestion was made that this meeting be held preferably at The Hague, in Holland, in the month of May or early in June, depending upon the completion of the work of the manufacturing experts. The work acomplished by the manufacturing experts will be reviewed at the proposed meeting of the I. E. C. advisory committee, at which as wide a representation as possible is suggested.

At the conference were Dr. C. O. Mailloux, president I. E. C.; C. le Maistre, secretary, and Percy Good, assistant secretary. The French delegate was C. Zetter, the Dutch delegate Dr. G. Holst, and the German delegation comprised Dr. H. Remane and Dr. Hermani. The British were represented by S. W. Attwell and E. G. Batt. The American delegation comprised Clayton Sharp, M. D. Cooper, S. E. Doane and F. V. Magalhaes. Italy was represented by Signor Clerici.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Fears Reaction of European Chaos on America

To the Editors of the ELECTRICAL WORLD:

As a result of a short business trip to Europe I have been so impressed by the uncertain conditions abroad that I cannot help believing our country will and must be affected to a great extent by what is happening in the Old World. I have made inquiries from many different sources and to my surprise I have always received the same answer. The people over there do not expect war, but they all fear that something is going to happen which may be worse than a war. In some countries there is a tendency to throw the governments over, and in others legislation is threatened which is destructive of capital and will undoubtedly throttle enterprise. Even the little Republic of Switzerland, which was saved from the horrors of war and has a currency almost on a par with our dollar, is going through a serious crisis in the way of legislation which is headed in the direction of communism. If the chaos in Europe grows greater, there is no telling what will happen, and I cannot help but fear that if Europe "blows up" the explosion will be badly felt in this country.

ARNOLD PFAU.

Allis-Chalmers Manufacturing Company,
Milwaukee, Wis.

Paper-Pillar Switch Insulation

To the Editors of the ELECTRICAL WORLD:

The interesting article in your issue of Jan. 13 by Clifford N. Anderson, entitled "Hydraulic Power-Plant Practice in Northern Europe," has brought to my mind some facts with reference to our practice here in the United States, particularly with reference to extra-high-voltage disconnecting switches and circuit breakers.

Mr. Anderson's article illustrates 100,000-volt disconnecting switches with paper-pillar insulators. It may interest your readers to know that a considerable number of paper-pillar-insulated disconnecting switches were supplied ten years ago to the Big Creek system of California for the 150,000-volt power-plant and substation equipment. These have given entirely successful and reliable service on this system, which is now operated by the Southern California Edison Company. The design of the switching equipment was carried out under the supervision of the writer, and the following data thereon may be of further interest.

In appearance the switches were practically the same as those illustrated, but they were equipped with somewhat larger "static shields" or "brush-discharge rings" than the paper-tube or pillar diameter. They were also equipped with corresponding brush-discharge rings at the base of the tubes or pillars to control better the distribution of the static field relative to the supporting structure. Air clearance between static shields, either between pillars or to ground, was approximately 4 feet.

It was during the development of the details for these switches and the oil circuit breakers for corresponding applications, as well as the details for the 132,000-volt and 110,000-volt applications made in the five years prior to 1912, that the advantages of proper static-field distribution both in air and in oil were demonstrated.

It is, moreover, interesting to note that the design of this 150,000-volt apparatus contemplated and the tests demonstrated its adequacy to withstand 500,000 volts at 60 cycles, based on three times 165,000 normal voltage to ground.

J. N. MAHONEY,
Consulting Engineer.

Brooklyn, N. Y.

Meter Maintenance on Scattered Systems

To the Editors of the ELECTRICAL WORLD:

I note with great interest an article on "Meter Maintenance on Scattered Systems" written by H. M. Johnson in the ELECTRICAL WORLD of Oct. 28 last. It occurs to the writer that Mr. Johnson is following a wise course in the method of testing large power meters that he employs. However, I am of the opinion that tests are made more often than necessary. Of course, where the consumption is large and expense of testing kept down to a minimum, the ratio of expense to income would largely control such a test. I am pleased to observe that an over-all test is made, as this is the practice of most Pacific Coast companies and has been for several years.

The company with which the writer is connected does not remove meters to relag for power factor. This is done by the use of a phase-shifting transformer made by J. C. Albert of Los Angeles. The test blocks used are satisfactory, but it would seem that a double switching arrangement would be more advisable as it would eliminate the possibilitiy of the tester coming in contact with high voltage while making connections. A scheme has been worked out by using two sets of cut-outs and a pole-top switch. The switch is locked open under normal conditions. We have found that outdoor current and potential transformers are more flexible and less expensive than self-contained metering outfits for primary voltage.

The arrangement of test instruments and equipment is worked out very well, and Mr. Johnson should be commended highly for the system which he describes.

W. H. TALBOTT,
Superintendent Electric Meter Department.

H. M. Byllesby & Company,
San Diego, Cal.

Water Resistance and Temperature

To the Editors of the ELECTRICAL WORLD:

In an article on electric boilers in the ELECTRICAL WORLD of Dec. 2, 1922, page 1211, the statement is made with reference to water resistance: "To this comes the very decided increase of resistance with increasing temperature." I have always found a decrease of resistance, the boiler current increasing quite rapidly as the water heats up. There is also a decrease of resistance due to concentration of impurities as the water evaporates, so the final resistance will be very much less than that of the feed water.

LOUIS E. MCCOY.

St. Maurice Lumber Company,
Three Rivers, Quebec.

[We agree that the above correction should be made. As a general principle water resistance decreases with an increase in temperature and we do not know of any impurities that might be present in sufficient quantity with negative temperature coefficients to offset this condition.—EDITORS.]

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Gaining Speed in Laying Tile Conduit

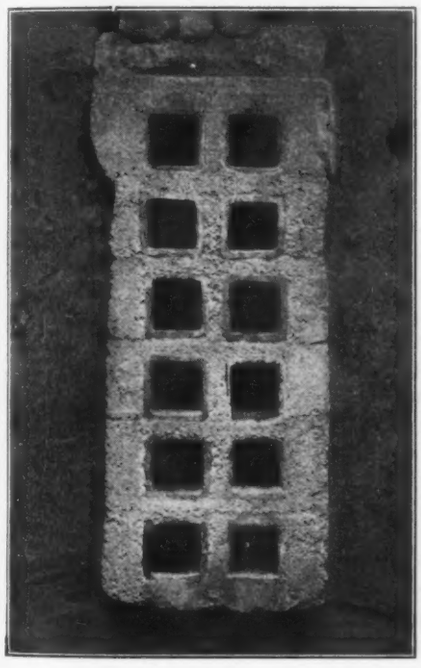
IN THE past two years a number of subway lines have been constructed in Kansas City with vitrified-clay conduit 4½ in. and 4 in. square, consisting of eight, ten and twelve ducts. The ducts were laid with 1½-in. separation, filled with a mixture consisting of one part Portland cement, three parts sharp sand and five parts ½-in. rock. When using this thick layer of concrete between ducts it was necessary to allow the concrete to set from eight to twelve hours before each successive layer was laid. It was found that if a second layer were laid on soft concrete there was considerable settling of the duct, throwing joints out of line.

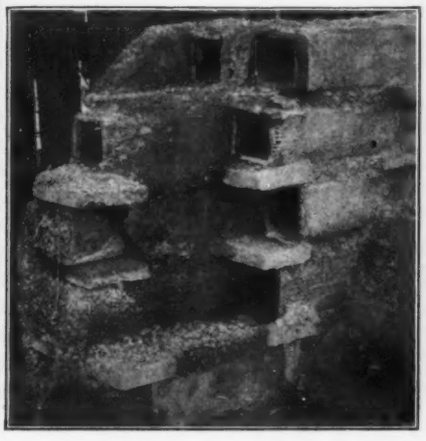
The method of laying was to paint both sides of the tile with paint and wrap 3-in. muslin around one end, painting the muslin thoroughly on the outside. This work was done on top of the trench by the helper and handed down to the layer, who painted the tile and the outside of the tape. There was no other fastening used to hold the tape—the paint drying very rapidly and making a comparatively firm joint. A 48-in. x 3¾-in. square mandrel made of hard maple was drawn through each duct as the layer advanced, the mandrels being drawn ahead.

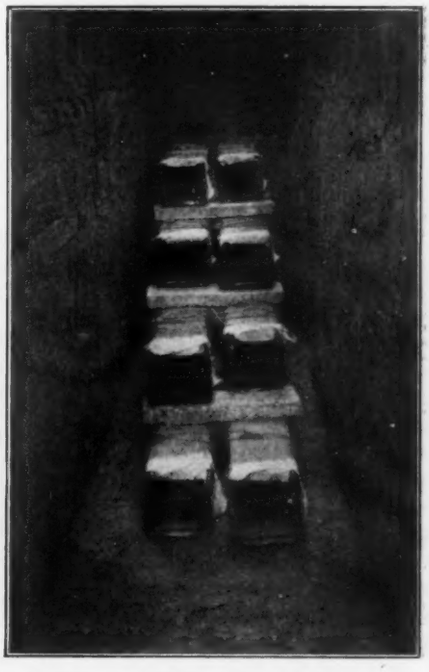
The manufacturer furnished this duct with a ⅞-in. wall in the 4½-in. duct and a ¾-in. wall in the 4-in. tile duct. The outside of tile was grooved, which has been the general plan in making tile duct. The manufacturer was asked to eliminate these grooves and make the outside plain. Considering the method of painting the tile and using the muslin for making joints tight, it was felt necessary to have a plain surface to eliminate the chance of cement or water leaking into joints during construction. There was thus a saving of time, as it was very simple to paint the smooth surface and insure tight joints. This change was made by the manufacturer and proved successful.

The problem of waiting for concrete to set as each successive layer was laid presented itself in cases where crossings were made under railroad tracks or in places where soil was difficult to hold in place. To speed up the work, the "built-up" method was employed, using concrete separators 6 in. wide by 12 in. long and 1½ in. thick. These were placed at each joint, laying two joints on each separation and staggering them approximately 2 in. When the eight, ten or twelve ducts were built up, sloppy concrete was poured from a wheelbarrow into a convex steel trough or chute, causing the concrete to flow to the sides of the trench and drain from the sides toward the conduit. In other words, the concrete flowed from the sides and bottom of the trench between the layers of duct, filling all voids. This is an improvement over the old method of dumping concrete on top of duct, which left voids between and at the bottom of duct line. While the concrete was being poured a long-handled tamper with a steel blade 10 in. wide, 20 in. long and ⅛ in. thick was used continuously, with an up-and-down motion, causing suction and helping to fill voids in the concrete.

A test section of conduit, consisting of ten ducts which were built up in the regular way, is shown in one of the illustrations. After setting for seven days the bank was







SUBWAY LINES CONSTRUCTED IN KANSAS CITY WITH VITRIFIED CONDUIT

Right—Built-up-in-the-trench method ready for concrete. The joints are staggered and painted tape laid over the ends ready for the next joint.

Center—Built-up method employed experimentally on a ten-duct line.

Left—A twelve-duct conduit built by the layer method ready for the construction of the concrete manhole.

torn down. No voids whatever were found. In another photograph the "built-up" method with part of the work concreted and back-filling work in progress is shown. It is approximately 12 ft. to the bottom of the trench on account of the fill-in at railroad tracks. In the third picture is shown a completed twelve-way subway line of 4½-in. duct. This is at the entrance to a manhole which has been excavated and is ready for the construction of the manhole walls.

T. C. RUHLING,
Superintendent Underground Distribution, Kansas City Power & Light Company, Kansas City, Mo.

Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Detailed Instructions for Boiler-Room Force

AMONG the principal points to consider in the operation of the boiler room of a power plant are these: Maintaining proper amount of water in boilers, evenly loading all units, protection of brick lining and stoker bearings, blowing down boilers to remove light contents from surface of water which tend to produce foaming, and blowing the main blow-off valves to remove sludge and scale-forming material that may be in the water.

The reasons for operating boilers at or near the same rating are as follows: (1) Greater reliability in following load variations, as the same increase in load can be taken up more rapidly and with less damage to the fires if the increase is made on a large number of boilers at moderate rating than it can when only a few are operating at a very high rating. For the same reason it is much easier for the operator to control boiler-feed water, prevent safety valves from blowing, control blowers and dampers, etc. (2) Trouble on any one boiler, necessitating taking it off from the line, can more easily be handled with boilers at same rating than if they were at different ratings. (3) Better efficiency of the boiler room as a whole is obtained. (4) The clinkers stick less in fires that are operated at low ratings. (5) The maintenance cost of furnace parts and outside stoker parts is greater on boilers that are operated at high rating than on boilers operated at medium ratings.

The actual operating code used by the Philadelphia Electric Company in the general operation of the boiler room follows:

1. After assuming responsibility for the shift, the boiler operator or water tender must not leave the boiler-room floor under any consideration without notifying the shift superintendent or boiler engineer, or, in the event that he has a stoker operator under him who is capable of tending water, he may notify this man that he is to take responsible charge. In any event the water tender or boiler operator must not leave the floor in time of trouble or impending trouble.

2. Maintain proper amount of water in each boiler when steaming.

3. All boilers should be operated at or near the same rating.

4. Draft and stoker speed should be set according to previously determined instructions.

5. Always maintain the draft over the fire as stated on the chart used for this purpose. Exception is made to this only for a short time in the case of dumps in stations where there is no means of putting air on the extension grates.

6. All extension grate dampers should be opened according to the general instructions of the boiler engineer.

7. Fires should be inspected by the water tender or boiler operator from the front, side and rear doors from time to time to determine their condition. This should be done by the aid of colored glasses made for this purpose.

8. When dumping time approaches all fires must be inspected, and those fires which have good coal on the dump plates must be burned down in the rear before dumping. If there is so much coke on the dump plates that it is impossible to burn it down properly, this coke should be winged back on the fire with a bar.

Where extension grates are installed, the rear of the fire may be burned down by opening the extension grate dampers. Where these are not installed, the rear boiler damper should be opened wider than usual.

9. Dump each fire as rapidly as possible, but allow sufficient time between boilers so that the steam pressure will not be affected.

10. With boilers equipped with clinker crushers, care must be taken to see that large clinkers do not form in such a position that they will not go through the rolls. This type of clinker should be hooked around with a bar so that its length is parallel with the clinker crusher.

The cinder in the crusher ash pit should be tested with the bar to determine if large clinkers are forming. The ash should be held at about half way up the long waterbacks and all the way up the short waterbacks.

11. Blow down the boiler from both the main and surface blow off (when provided) according to the instructions of the boiler engineer. The main "blow-down" should be made with the boiler banked if possible. The surface "blow-down" should be made while steaming.

12. The blow-off valves of the economizers should be operated according to instructions of the boiler engineer. Feed-water valves to economizers should be opened and valves to the boiler should be closed while blowing down the economizer.

13. The procedure in blowing down main blow-offs is as follows: (a) Open plug cocks with lever wrench; (b) open main blow-off valves slowly; (c) close main blow-off valves slowly, and (d) close plug cocks with lever wrench. While blowing down, the water tender should watch the level of the water in the gage glass.

14. The water tender should enter on a suitable boiler-room log sheet the number of hours each boiler was steaming, floating on the line, banked and out of service, the time of dumping, the number of hours the fans were in operation, and the reading of the stoker counters at midnight or at a predetermined time.

Switching on Lines

TRANSMISSION and distribution lines above 6,000 volts are energized from the source end as a precaution against service interruptions. If a faulty line is put on at the generating station this line will trip out without causing any further disturbance. If, however, it is put on at the substation end, it may trip out the lines feeding the substation and cause the loss of the entire substation load. Likewise, where two lines feed an industrial consumer, if the second line is energized at the industrial load consumer's end and if it is faulty it may trip out the loaded line, causing the loss of his entire load; whereas if the second line were energized at the substation, the fault current would be a smaller proportion of the capacity of the substation lines and therefore less likely to cause interruption.

The instructions issued by the Philadelphia Electric Company covering switching on transmission and distribution lines are given in the following paragraphs:

1. All lines must be energized from the source end, whether originating at a generating-station bus or at a substation bus.

2. Operators must wait for a pilot light on an incoming line before paralleling, unless otherwise instructed by the load dispatcher. No lines shall be paralleled without first synchronizing, in stations where the bus may be energized from separate sources.

3. When a line is put back in service after an interruption, the operator should watch its ammeter closely, and if the load does not come on within three minutes, the load dispatcher must be notified.

Field Testing of Insulators Essential to Good Service

"DESPITE the fact that insulator manufacturers are all turning out much better material than they were able to do several years ago, we as operating engineers still have to wipe out the old picture of restoring service as quickly as possible after a shutdown," declared J. H. Sturge, division superintendent Public Service Electric Company, New Jersey, before a recent meeting of the Boston Section of the A. I. E. E., discussing a paper by Frank C. Doble of the Doble Engineering Company, Boston, on "Insulator Testing Problems."

Mr. Sturge said: "Now the pic-

TESTING PIN-TYPE INSULATORS ON LIVE LINES

ture is that there must be no shutdown. This means that we must be able to locate defective insulators easily and safely without taking the line out of service." He pointed out that last year a line 50 miles long was tested by this method. The line was equipped with three-piece insulators and was connected grounded-Y and operated at 26,400 volts. Every pole was climbed with the line shut down, every insulator was examined, and every insulator showing visual defects such as hair-line cracks and chipped shells was removed before applying the Doble test. Two per cent of the total insulators were thus removed from the line after this visual inspection. The line was then put into service and gone over again with the Doble tester, with the result that 1 per cent of the insulators were indicated as defective. These insulators when removed to the laboratory were tested and all were found defective in fact. Mr. Sturge said that he would not adopt any other known method, such as the short-circuit method, because of lack of safety.

K. A. Hawley, Locke Insulator Corporation, Victor, N. Y., pointed out that there were about twenty-five million insulators in service in the United States and that some means for testing them in the field is very valuable. Insulators began to be put out twenty-five to thirty years ago, and a fair percentage of the early ones are still in use. The quality of insulators is being improved year by year. The causes of depreciation of insulators are, first, bursting due to internal stress; second, moisture absorption, due to porous porcelain. These two types of failure deserve separate consideration. When an insulator is on its way to complete failure, it constitutes a hazard to the system. An insulator which will not megger infinity is either cracking or leaking through absorption of water. A three-piece insulator in good condition should show better than 200,000 volts on puncture test, and a suspension type which flashes over at 90,000 volts would not be likely to puncture at a potential under 130,000 volts.

INSULATORS WILL ALWAYS REQUIRE SERVICE TESTS

Prof. D. C. Jackson of the Massachusetts Institute of Technology doubted whether the industry would ever reach the point where insulators would attain such perfection of design and manufacture as to require no tests in service. Tests will cost less than the interest on the cost of overinsulation of lines, buses, etc.

It was generally recognized in the discussion (1) that every transmission-line insulator should be tested in the field before being placed in service, (2) that every insulator in the field should be tested periodically, (3) that live-line testing is most satisfactory from the standpoint of cost and efficiency, and (4) that live-line testing apparatus should protect the operator from direct shock and protect the insulator under test from short circuit of its parts, reduction in leakage path and potential in excess of normal operating value.

A vital need of today is an agreement in the industry upon some standards to determine when an insulator is bad enough to warrant its removal from service.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Mixed Culm and New Coal Keeps Up Service

BY COMBINING culm with freshly mined coal the Ohio Power Company was able to utilize its reserve of culm coal in maintaining service during the coal strike. This system of blending culm with the newly mined coal has been in operation for the past six years. By this method the average cost per ton of mixed coal burned was lower than the price of the coal obtained during the coal-strike period and burned alone. Although no comparative figures on the cost of plant operation have been completed, about 15 per cent more storage slack, or culm coal is required for the same steaming capac-

LOADING THE MIXED COAL BY BELT CONVEYOR

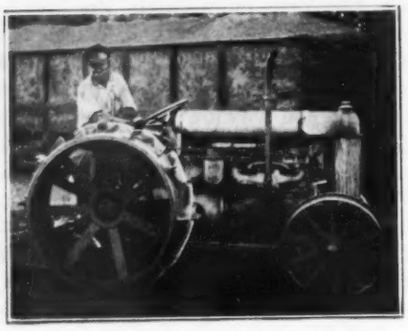
ity that is obtained from freshly mined coal.

During the miners' strike a weekly maximum tonnage of 1,750 was loaded at Cambridge, the location of the culm piles, and shipped into Newark. To do this three gasoline tractors were employed, together with teams, and the total cost of loading operation was reduced 50 per cent compared with an all-team equipment. The illustration on the following page shows the tractor in use for reclaiming the slack coal.

In mixing this slack coal with the freshly mined the method used is that when the bunkers are filled one bucket of culm slack and then one bucket of freshly mined coal are placed into the bunkers at one time. While this does not give a uniform mixture, experience has shown that the desired results are obtained. An average heating value of this mixed coal is about 12,000 B.t.u. The only

objection in using culm is that the soot and dust become a nuisance, but by employing a balanced draft and keeping the coal sufficiently wet before it goes into the furnace troubles of this nature have been reduced about 50 per cent.

The company has about 100,000



GASOLINE TRACTOR LOWERS LOADING EXPENSE 50 PER CENT

tons of this slack coal in storage and has found it valuable in giving continuous uninterrupted service regardless of the market price of coal.

E. T. WAGENHALS,
Manager.
Ohio Power Company,
Newark, Ohio.

Three-Phase Transformer Rating Standardized

STANDARD ratings for three-phase power transformers have been augmented recently by the Electric Power Club to include the range between 44,000 volts and 220,000 volts. These ratings have been adopted and became effective Jan. 1, 1923. The standard sizes, voltage ratings and taps of stepdown transformers for supplying lighting and power service as they now stand are given in the accompanying table.

The standard type of transformers for this class of service are self-cooled oil-immersed, water-cooled oil immersed, and air blast. The application of air-blast transformers is confined to systems where the voltage does not exceed 25,000. Standard frequencies are 25 cycles and 60 cycles. Standard sizes for oil-immersed self-cooled transformers in kilovolt-amperes continuous rating at 55 deg. C. rise are 300, 450, 600, 750, 1,000, 1,200, 1,500, 2,000, 2,500, 3,000, 3,750, 5,000 6,000, 7,500, 10,000, 15,000, 20,000, 25,000 and 30,000. For water-cooled oil-immersed or air-blast transformers the lowest rating is 750 kva., the sizes above this being the same as for the self-cooled type.

Transformers having low voltage rating of 230/460 are suitable for series or multiple service only. Standard three-phase step-down power transformers for supplying secondary distribution and having voltage ratings listed in the table will be designed for successful operation when excited on full winding at 5 per cent above their rated voltage. Standard three-phase step-down power transformers having voltage rating as given in the table are not suitable for supplying 4,000-volt distribution as such service would necessitate a "Y" connection on both high-voltage and low-voltage side simultaneously, and this connection might result in excessive stress in the winding due to harmonic voltages.

When a standard transformer is suitable for normal application to two voltage ratings, this flexibility will be definitely indicated on the nameplate, on the connection diagram or on a poster inside the transformer cover.

The standard ratings for three-phase distribution transformers in

THREE-PHASE POWER TRANSFORMERS FOR SUPPLYING LIGHTING AND POWER SERVICE

Voltage ratings shown in bold type are the normal voltage ratings of these lines and, unless otherwise specifically requested, manufacturers will offer guarantees covering electrical characteristics such as efficiency, regulation, etc., on these normal-voltage ratings only.

For Supplying Service Voltages 600 and Below

Standard-System Voltages	Standard Sizes for Each Voltage Class: Oil-Immersed Self-Cooled	Transformer High-Voltage Ratings for Operation from Various Standard-System Voltages: On Full Winding	Approximately on Taps: 5%	Approximately on Taps: 10%	Transformer Low-Voltage Ratings for Supplying Service Voltages of 600 and Below
2,300	300 to 1,500	2,200/3,810Y **2,300 4,000Y**	2,090/3,615Y 2,185/3,785Y	1,980/3,430Y 2,070/3,585Y	.....to 220/440 .....or to 550 .....to **230/460** .....or to 575
4,600	300 to 1,500	2,200Y 4,400Y **2,300Y** **4,600Y**	2,090 4,180 2,185 4,370	1,980 3,960 2,070 4,140	.....to 220/440 .....or to 550 .....to **230/460** .....or to 575
6,600	300 to 1,500	6,600Y 6,900Y	6,270 6,555	5,940 6,210	.....to 220/440 .....or to 550 .....to **230/460** .....or to 575
11,000	300 to 1,500	11,000Y **11,500Y**	10,450 10,925	9,900 10,350	.....to 220/440 .....or to 550 .....to **230/460** .....or to 575
13,200	300 to 1,500	13,200Y **13,800Y**	12,540 13,110	11,880 12,420	.....to 220/440 .....or to 550 .....to **230/460** .....or to 575
22,000	300 to 1,500	22,000Y **23,000Y**	20,900 21,850	19,800 20,700	.....to 220/440 .....or to 550 .....to **230/460** .....or to 575
33,000	300 to 1,500	33,000Y **34,500Y**	31,350 32,775	29,700 31,050	.....to 220/440 .....or to 550 .....to **230/460** .....or to 557

For Supplying Distribution Voltages Above 600

Standard-System Voltages	Standard Sizes for Each Voltage Class: Oil-Immersed Self-Cooled	Standard Sizes for Each Voltage Class: Oil-Immersed Water-Cooled or Air-Blast	Transformer High-Voltage Ratings for Operation from Various Standard-System Voltages: On Full Winding	Approximately on Taps: 5%	Approximately on Taps: 10%	Transformer Low-Voltage Ratings for Supplying Secondary Distribution
6,600	300 to 3,000	750 to 7,500	**6,600Y**	6,270	5,940	..to **2,300**
11,000	300 to 7,500	750 to 15,000	**11,000Y**	10,450	9,900	..to **2,300**
13,200	300 to 7,500	750 to 15,000	**13,200Y**	12,540	11,880	..to **2,300**
22,000	300 to 7,500	750 to 15,000	**22,000Y**	20,900	19,800	..to **2,300**..or to **6,900**
33,000	300 to 7,500	750 to 15,000	**33,000Y**	31,350	29,700	..to **2,300**..or to **6,900**..or to **11,500**..or to 13,800
44,000	300 to 10,000	750 to 15,000	**44,000Y**	41,800	39,600	..to **2,300**..or to **6,900**..or to **11,500**..or to 13,800
66,000	300 to 10,000	750 to 15,000	**66,000Y**	62,700	59,400	..to **2,300**..or to **6,900**..or to **11,500**..or to 13,800
88,000	1,200 to 10,000	1,500 to 15,000	**88,000Y**	83,600	79,200	..to **2,300**..or to **6,900**..or to **11,500**..or to 13,800
110,000	2,000 to 10,000	2,500 to 15,000	**110,000Y**	104,500	99,000	..to **2,300**..or to **6,900**..or to **11,500**..or to 13,800
132,000	2,500 to 10,000	3,000 to 15,000	**132,000Y**	125,400	118,800	..to **2,300**..or to **6,900**..or to **11,500**..or to 13,800
154,000	3,000 to 10,000	3,750 to 16,000	**154,000Y**	146,300	138,600	..to **2,300**..or to **6,900**..or to **11,500**..or to 13,800
220,000	3,750 to 10,000	5,000 to 15,000	**220,000Y**	209,000	198,000	..to **2,300**..or to **6,900**..or to **11,500**..or to 13,800

the 6,600, 11,000, 13,200, 22,000 and 33,000-volt classes have been modified to include two 5 per cent full-capacity taps in the high-voltage winding instead of one 10 per cent tap.

These standards will be incorporated in the next edition of the Electric Power Club Handbook.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Rigid Transformer Supports Insure Reliable Service

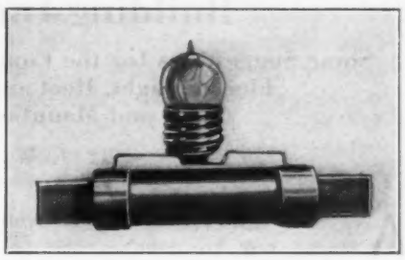
IN SUPPLYING energy to industrial plants service entrances and transformers are frequently placed on walls, roofs or other exposed places, and mechanical strength in wiring supports is vital to continuous service. Four examples of recent installations designed with this requirement in mind are shown herewith. A transformer installation of unusual compactness and rigidity is shown in Fig. 1 of the illustration. The transformers are hung by metal straps from a horizontal angle iron bolted through the factory wall, the comparatively low-voltage primary leads being run at the top of the bank in rigid conduit, with short taps into the cases, appropriately drip-looped. The secondaries, running single-phase, are carried up the side of the building from one unit and into the factory direct from the other two. The weight of the transformer bank is further supported by a horizontal strap at the bottoms of the cases, with bolts into the pilasters and window casings as shown. The bank takes up little space outside the bays between pilasters, and the wiring is adequately safeguarded.

A transformer installation on an industrial plant roof is shown in Fig. 2, under construction. A simple frame of vertical and horizontal angle irons carries insulators at the top for an outdoor bus line, and at the intermediate height are secured tie rods and strain insulators by which an incoming three-phase circuit can be dead-ended and provide ample space for downward taps into the transformer casing. A convenient means of carrying various circuits over the cornice of an industrial building and downward toward the street for an overhead crossing is shown in Fig. 3. Here angle-iron bracing firmly attached to the building wall is equipped with insulators carried far enough out to provide a desired separation of circuits, clearing the wall satisfactorily and still accessible with reasonable care for future changes. In place of the unsightly runs of heavy cables and home-made wooden frames sometimes used in supplying energy to industrial establishments via the roof, the use of rigid conduit and junction boxes in Fig. 4 is of interest. The joints are copper-flashed to keep out moisture, and intermediate supports for the conduit run are in the form of rings attached to horizontal crossbars carried on vertical pipe risers. The last are seated in foundation blocks fastened to the roof. Changes in direction are easily made at the junction boxes, and the whole installation has a "shipshape" appearance far from usual in industrial applications of electrical importance.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Indicator for Blown Fuses Increases Production

INTERRUPTION to the chain of production, discouragement of speeding piece workers and opportunity for complaints and excuses caused by blown fuses can be completely avoided by those who will



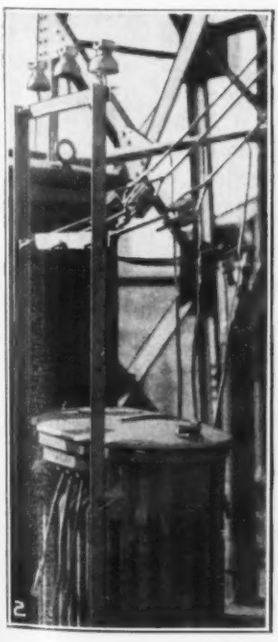
TEST LAMP ON FUSE INDICATES WHEN FUSE HAS BLOWN

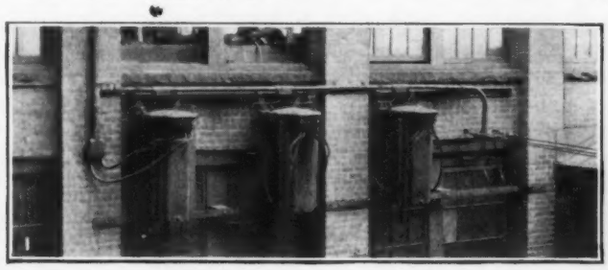
take the trouble to have small test lamps permanently installed on each fuse and a supply of proper fuses in readiness. Lamps in their sockets can be installed on the outside of fuse boxes and the wires run to the fuses within the box.

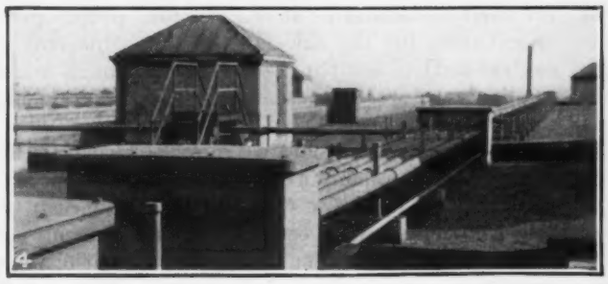
By this arrangement the test lamp is shunted by the fuse so that when the fuse blows the circuit is completed through the lamp and indicates the trouble. Lamps should be of low wattage and of the same voltage as the circuit on which they are to be used.

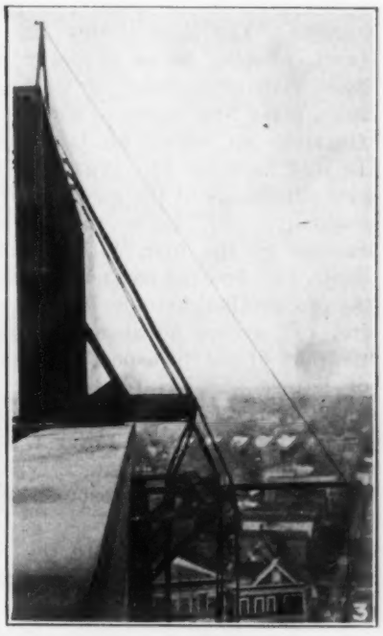
Because of the installation of these fuse indicators in one shop the improvement in morale has been very marked and the slight expense has been returned many times in increased production.

C. F. P. CARRIER,
Philadelphia, Pa. Engineer.









FOUR GOOD EXAMPLES OF INDUSTRIAL POWER INSTALLATIONS WITH AMPLE PROVISION FOR ADEQUATE MECHANICAL STRENGTH

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Building Industrial Load

Some Suggestions for the Commercial Man on Developing the Electric Light, Heat and Power Loads in Shops and Manufacturing Plants

By J. W. Carpenter
A. E. Fitkin & Company, New York, N. Y.

ANY central-station man who starts out to develop the industrial load of his company has three distinct opportunities in every place of business he may approach. He is able to offer modern lighting, power and industrial electric heating.

Each of these services is something which can be sold if the proper study is given to the development of demand and if the selling effort is maintained. The reward for the effort expended in securing this business is found in the substantial additions to gross income, the large increase in business through one contract that may equal several dozen residential contracts, and the satisfaction that comes with the knowledge that there has been a distinct step of progress by the new customer.

Prerequisites for Developing Industrial Load

There are certain fundamentals in the development and negotiation of industrial load that must be followed carefully to insure continued success. The man closing the contract, whether he be property manager, visiting engineer or local salesman, must first study externally the situation on which he is to work. In this he must (1) grasp the general conditions of the business of the company, (2) know the personal fancies of the men with whom he deals, (3) find the particular need of the prospective customer for the service, (4) arouse advance interest on the part of the "prospect" by the use of letters and printed matter, (5) know of the recent developments in electric apparatus in order that he can recommend the newest types of equipment or the most advanced practices.

There is in addition to the foregoing one urgent caution. Negotiations should be started with the chief executive of the prospect company. Many times successful efforts have been made to convince plant engineers, foremen or superintendents of the advisability of adopting electric service, but the entire negotiation has fallen through when it is carried to the owner or general manager because he had not grasped the situation first. On the other hand, if the man at the top is approached first in an introductory way, he will be waiting for a report of the details which are worked out with his subordinates.

Lighting

A man working on industrial business has much to offer. In the lighting field there is unlimited opportunity for load. Probably about 95 per cent of the factories and shops in this country need a completely new lighting installation. Commercial men can readily call to mind the inadequate lighting in many places in their own district where outlets are placed in haphazard fashion, lamps are too small and dust covers the fixtures. Such conditions are crying for attention. The industrial emergency during the war taught us that better and brighter light brings greater production and finer workmanship.

Any man who will take a few lamps under his arm can find places enough for their installation. It is a specific opportunity for the salesman in the central-station company or for the local contractors. Any manager who will convince just one local contractor of the profit he can obtain from rewiring and relamping industrial plants in his territory will find that the contractor, the central-station company and the customer will profit greatly.

In the power field there is large opportunity for increased business that calls for intelligent, diplomatic and persistent effort. The Electrical World for Jan. 6, 1923, tells us that the industrial field of the central station is only one-third developed. There are certain common methods of obtaining this load: (1) by gaining a foothold with an initial installation, (2) emergency service, (3) new building, or (4) complete conversion.

Power and Heating

In the first of these the central station gets a small load by installing a motor or two and perhaps all of the lighting, owing to the overloaded condition of the isolated plant. This will lead, with good service and treatment, to the gradual acquirement of the entire load. In the second case a broken-down engine, a leaky boiler or a fire gives an energetic central station a chance to install one large motor for urgent power needs. Perhaps this will be used for only a short time, but the convenience of that electric drive will bring the entire load over with group or individual drive in a short time. In the third case—new building—it is comparatively easy to obtain the motor load.

By the use of manufacturers' data and the information prepared by the national electrical societies the isolated plant can be shown to be much more expensive in first cost and in operating costs. This is particularly true if sufficient weight is placed upon the cost of duplicate equipment needed in an isolated plant for continuous service. In the fourth case, complete conversion of a plant requires particularly the proper preliminary work, careful engineering and continuous follow-up. Rome wasn't built in a day, and a private plant cannot be converted overnight. Securing the power contract for a plant of from 100 hp. to 500 hp. after a year of negotiations is pretty good work. However, the economy and convenience of central-station service will conquer the most stubborn "prospect" if the story is brought to him often enough.

The newest field for development is industrial electric heating. Many electrical men know very little about it and do not appreciate its possibilities. Nevertheless, electric heating in industrial processes is growing by leaps and bounds. Paint drying, bread baking, japanning, core baking, heat treating, vitreous enameling, brass melting and steel refining are a few of the things accomplished electrically. All of these cannot be done so cheaply by electric heat as with some other sources of heat, when fuel cost alone is considered, but other economies in saving of material and improved quality of the product more than offset the difference in cost.

Follow-Up Essential

Finally, the cardinal rule of the golfer, to "follow through," applies equally well to the central-station business. Quiet but persistent, polite but tenacious "follow-through" is needed until the contract for new business has been signed and forgotten by the customer who has learned to consider this service as an integral part of his operations.

Servicing Electric Ranges

Company Policy — Chief Causes of Trouble and Cost of Maintenance and Repair Work

By A. H. Kruel

Assistant Superintendent Meter and Service Department, Portland (Ore.) Railway, Light & Power Company

On NOV. 1, 1922, there were 1,475 electric ranges on the lines of the Portland Railway, Light & Power Company, and approximately 125 additional range sales had been booked, which would bring the total up to 1,600 at the end of the year. To keep these ranges in satisfactory operating condition the company has adopted a very liberal attitude in its repair service. The policy is to maintain each range connected—largely without cost to the customer for material or labor—indefinitely.

This service includes elements, plates, switches, thermostats, door springs and hinges, racks and pans. It also includes refinishing and painting of oven linings to a limited extent, but does not provide for new linings except when renewed within the year's guarantee of the manufacturer because of defectiveness. All other repairs are made for the cost of material only to the customer unless the range requires a general overhauling in the shop, for which a charge for both labor and material is made. The range service applies to all ranges, whether purchased through the company, the retailer or the competitive power company, as long as they are served by this company.

Three Principal Causes of Trouble

The most common complaint from customers is that the plates or ovens do not heat. Aside from the heating elements being defective, this complaint is due to, first, the range being equipped with plates or oven

PORTLAND COMPANY'S ELECTRIC RANGE SERVICE CAR

elements designed for a higher voltage than that of the distribution system; second, low voltage on the range, which requires increased transformer capacity, and, third, defective thermostats on the ovens. Much emphasis is placed upon this third cause for low heat, because practically all range customers rely entirely upon the indicated heat as shown by the thermostat. Such a wide variation is shown in thermostats of the same make that consumers are advised by range service men to disregard the tables sent out with ranges for various cooking heats and to use their own judgment about the quantity of heat required. There seems yet to be designed the perfectly efficient and reliable thermostat. The greatest common defect of electric ranges is the short life of the heating element. Table I shows a classification of complaints

TABLE I—CLASSIFICATION OF RANGE COMPLAINTS

Defects	Number
Coils and plates	443
Contacts	116
Door springs and hinges	75
Oven elements	44
Thermostats	34
Painting ovens	33
Switches	26
New linings	17
Shorts, grounds and miscellaneous calls	365
Total	1,153

TABLE II—COST OF SERVICING ELECTRIC RANGES

Year	Complaints	Average Ranges in Service	Complaints per Range	Material Cost per Range	Labor Cost per Range	Total Cost per Range
1919	1,153	456	2.1	$1.56	$3.96	$5.52
1920	1,506	701	2.1	3.34	4.54	7.88
1921	2,009	846	2.3	2.53	5.31	7.84

on service calls received during 1919. No summary has been made at a later date. Table II shows the costs of maintaining electric ranges for three years, not including 1922.

Two service automobiles, similar to the one shown in the accompanying illustration, equipped with a full stock of range parts are used in servicing ranges. In addition, a third machine takes care of new installations and also does service work when necessary. One of the two service machines can also make deliveries and installations when occasion demands. Five ranges have been delivered and installed in one day by one machine, and occasionally both machines have installed as high as nine ranges in one day. At present there are three range men with a helper to service and install ranges besides the one man (sometimes two) who burns off and sets up ranges for delivery from the shop. About six hundred new ranges were added to the system during 1922, and the indications are that this number will be exceeded in 1923.

To Win the Confidence of the Public

THE Interstate Power Company of McGregor, Iowa, which serves a number of communities in southwestern Wisconsin and northeastern Iowa, has adopted a policy of taking the public into its confidence which is reacting in the company's favor. From time to time small properties have been purchased and added to the company's transmission system, which extends on both sides of the Mississippi River. While these different properties were in process of being interconnected it was not possible to render 100 per cent service. In some cases misunderstandings arose, and to clear away such difficulties and create good will for the company moderate advertising campaigns are being carried on in the towns served.

As new additions to the company's plant and property are made an-

nouncements are carried in all the newspapers published in the communities. For instance, when connection had been established with a new hydro-electric plant at Prairie du Sac, Wis., an announcement was made stating that this plant had become a part of the company's system and would give the territory another source of water power which would increase the reliability of the service. In one case an interruption to the service, caused when a house mover fouled the company's transmission line, was explained as follows:

WHY THE LIGHTS WENT OUT

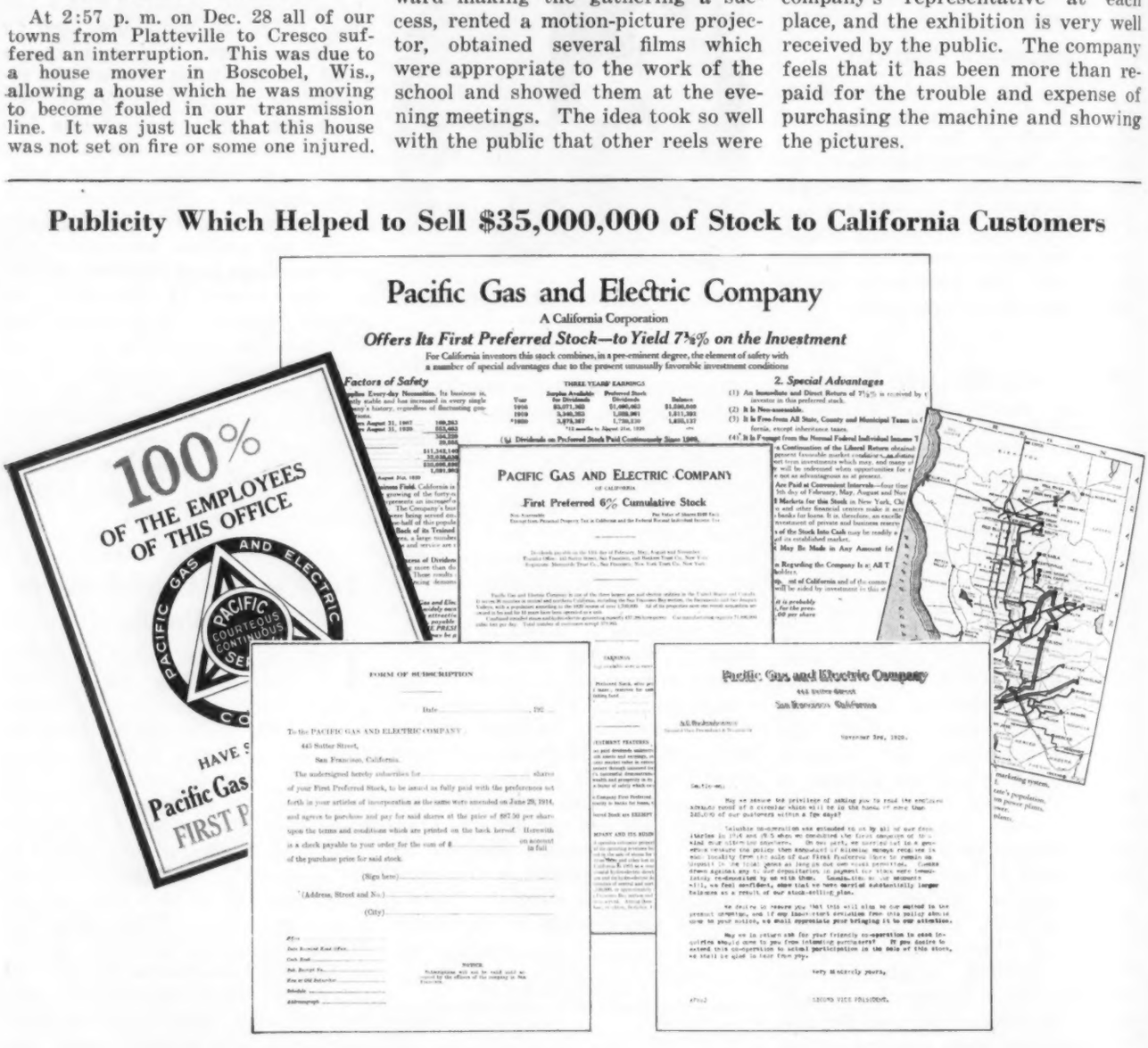
At 2:57 p. m. on Dec. 28 all of our towns from Platteville to Cresco suffered an interruption. This was due to a house mover in Boscobel, Wis., allowing a house which he was moving to become fouled in our transmission line. It was just luck that this house was not set on fire or some one injured. All towns suffered minor interruptions, and Boscobel was without service for two hours and a half.

If any one who has trees to trim or houses to move which will come near our lines will notify our local representatives or the general office at McGregor, we shall gladly have representatives on the job to prevent damage to property or interruptions to service.

In an effort to educate the public and win its confidence in another direction, the company is making use of a motion-picture machine. Last summer during a wild-life school for nature study which is conducted at McGregor every year the Interstate Power Company, to do its part toward making the gathering a success, rented a motion-picture projector, obtained several films which were appropriate to the work of the school and showed them at the evening meetings. The idea took so well with the public that other reels were shown at the request of the women's clubs and church organizations. It became so popular that the company purchased the projector and screen, which are now kept at its headquarters subject to call.

A photographer has been sent over all of the company's lines and has taken pictures of the transmission system, stations and scenes along the lines and in the towns served. One of the company's engineers is now making the rounds of the various communities served, showing the reels in the different motion-picture theaters. Invitations to prominent men and women are extended by the company's representative at each place, and the exhibition is very well received by the public. The company feels that it has been more than repaid for the trouble and expense of purchasing the machine and showing the pictures.

Publicity Which Helped to Sell $35,000,000 of Stock to California Customers



WHEN the Pacific Gas & Electric Company first opened its customer-ownership campaign in 1914 it adopted a definite policy of keeping its stock constantly in the mind both of the public and of its employees. This was accomplished through a well-planned program of newspaper advertising, reading notices, display cards and frequent bulletins to employees, all of whom at some time have acted as salesmen. Typical examples of the different forms of advertising used are shown above.

During the eight and one-half years of the campaign the volume of stock sold at any particular time has been in direct proportion to the amount of money which was being sent for advertising. Over the entire period, in which more than $35,000,000 of preferred stock has been sold, the advertising expense has averaged only 84 cents per share.

Elimination of Red Tape Improves Service

VARIOUS steps toward making relations with the public smoother were described in a recent address before managers of Stone & Webster properties by Gardner Rogers, manager of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I. During the past year many minor changes have been made in business methods, in an effort to eliminate red tape, complicated forms and everything appearing intricate or arbitrary in relations with the public. Representatives of the company have also endeavored to introduce a little extra courtesy in their dealings with customers.

To all new customers a courteous multigraphed letter is sent when their order for service has been taken. All customers who have registered trouble calls are called on the telephone to see if the trouble has been satisfactorily remedied, and if they cannot be reached in this way, a letter is written. A card is being sent to customers, accompanying their final bill, thanking them for their patronage and hoping for a further renewal of business relations.

CUSTOMERS SHOULD "ORDER," NOT "APPLY" FOR, SERVICE

All signed orders for gas and electric service have been eliminated, and the management believes this is one of the biggest steps so far in the interest of good public relations. "A good while ago," said Mr. Rogers, "we came to the conclusion that when a customer wants to buy service he should be allowed to *order* rather than to request or apply for it. Either gas or electric service may now be secured on telephone order and wherever possible we set the meter immediately upon receipt of such an order, without waiting for credit to be established. If we find a deposit is needed, it is secured after the meter has been installed. We feel that this is a step in the direction of both quicker and more acceptable service.

"We have reduced considerably the number of deposits required and are now taking them only in case of customers who appear to indicate less than an even chance of prompt payment. We are taking only about half as many deposits per thousand new customers as we were doing a year ago, the present ratio being about one to eight."

The company has also started refunding old deposits to customers who have established their credit. This refunding is proceeding gradually. The money now held as deposits, divided by total customers, is $1 as against $1.26 two years ago.

What Other Companies Are Doing

Hartford, Conn.—Less than two-tenths of 1 per cent of the 39,000 residential customers of the Hartford Electric Light Company requested the restoration of the former rate of 10 cents per kilowatt-hour after a year's trial of the company's new rate comprising an area charge plus 6 cents per kilowatt-hour. This rate went into effect in January, 1922. The company offered to rescind the new rate after twelve months' use in case of dissatisfaction, and as the year closed it published in the daily press form letter blanks addressed to the Mayor, in order to facilitate the filing of objections.

Chicago, Ill.—Subsidiary operating companies of the Middle West Utilities Company on Dec. 1, 1922, had a total of 394,706 customers, or an increase of 58,555, this representing a gain of 17.4 per cent in twelve months. Connected load of these companies on Dec. 1 was 333,890 kw., an increase in twelve months of 104,152 kw., or 24.3 per cent. Merchandise sales for the twelve months were $1,450,755, or a gain of 20 per cent over the previous twelve months.

Tacoma, Wash. — In the last year out of 847 employees of the Tacoma division of the Puget Sound Power & Light Company, 501 have purchased stock in the company. This, in connection with the previous sale of notes to employees and to the public, has been a factor in the improvement of public relations, according to a report presented before a recent convention of managers of companies operated by Stone & Webster, Inc.

Lake Geneva, Wis. — Forty-two employees of the Southern Wisconsin Electric Company received Christmas presents in the form of paid-up life-insurance policies of from $500 to $1,500, depending upon their length of service. The policies were taken out by the company under the "group" life-insurance plan and total in amount of insurance $36,000. Nine employees received policies for $1,500, two for $1,200, two for $1,000, six for $800, sixteen for $600, six for $500, and one a policy for $700. Every employee who had served with the company on or before June 30, 1922, received a policy for $500, those who had served a year and less than two years $600, two years and less than three years $700, three years and less than four years $800, four years and less than five years $1,000, and six years and more $1,500. The policies are so drawn that should an employee leave the service of the company he can continue the insurance by paying the premium himself.

Salem, Mass. — Before central-station service was introduced into the mills of the Naumkeag Steam Cotton Company, it was customary, as in many other engine-driven factories making textile goods, to shut down the plant annually for painting and repairs to machinery. In 1914 this establishment opened a new plant supplied with energy by the Salem Electric Lighting Company, and until the summer of 1922 no shutdowns were necessary for general overhauling. The argument for central-station service and the motor drive is obvious.

Pawtucket, R. I. — New power business to the amount of over 2,600 kw. was contracted for during 1922 by the Pawtucket division of the Blackstone Valley Gas & Electric Company, 2,160 kw. of this representing actual gain in power load. As a result of obtaining this business three steam engines and one oil engine were shut down and considerable inroads were made into the power load carried by three other private steam plants operating in the territory.

Ann Arbor, Mich.—Next Easter vacation at the University of Michigan the electric light and power men of Michigan will gather for a week of intensive study and demonstration of the principles of good wiring and installation and handling of meters. A short course has been designed to cover most of the demands for a high standard of service as required by the Michigan Public Utilities Commission in a recent general order. Those in charge of the course from the university department of engineering are Profs. B. F. Bailey, Joseph H. Cannon, H. H. Higbie and A. H. Lovell; for the Michigan Electric Light Association, Herbert Silvester, Ann Arbor, secretary; J. C. Langdell, A. S. Albright and Oscar Hauser, Detroit.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

An Ultimate 65,000-Kw. English Power Plant.—The first 10,000-kw. turbo-generator unit for the new power plant at Leicester, England, has recently been placed in operation. While this amount of power is all that can be generated at this time, space is available for extension until a total capacity of 65,000 kw. is reached. An interesting feature of the station is the arrangement of the oil-break switches and other apparatus necessary for controlling the electrical output. The layout of the switching equipment in relation to the rest of the station is of the most up-to-date character.—*Electrician*, Dec. 15, 1922.

Principles of Boiler Design.—The leading principles involved in boiler design with special reference to economy are reviewed. The main points brought up are high furnace temperature effects, convection and velocity of gases, natural draft, air heaters, superheaters, economizers, high velocity of flames, reductions of furnace temperatures and oil burning.—*Engineer*, Dec. 22, 1922.

Fuel Oil Versus Steam Engines for Small Power Plants.—G. T. PRINCE.—Advantages of oil engines for municipal plants, experiences with Diesel engines and the high cost of coal affecting steam-engine operation are the main subjects discussed in this paper.—*Canadian Engineer*, Dec. 26, 1922.

Generation, Control and Switching

Operation and Control of Storage Batteries in Central Stations.—A. FASTMAN. — Out-of-balance charging current should be minimized as far as possible, extent of charging should be limited, and floating charge should be avoided, while in addition observation of appearance of cells should play an important part during charging and observation of instruments should be practiced at all times, together with a careful regard to the working instruction card. If proper care and treatment are given to storage batteries and reliable judgment is cultivated by careful attention, depreciation can be avoided to a considerable extent.—*Electrical Review*, Dec. 22, 1922.

Power Factor, Its Physical Meaning and Commercial Manipulation.—W. G. H. CAM.—In discussing the question of power factor, the author first reviews the fundamental relations of electricity in order to create a background upon which to base his arguments. He then considers the advantages of keeping a plant power factor in the neighborhood of 100 per cent and describes the various methods by which this may be accomplished. — *Engineering Journal*, (*Canada*) January, 1923.

Reducing Electrical Hazards in the Industrial Plant.—Installation of modern types of inclosed and remote-controlled switches, the placing of all wires in conduits, the educating of employees to the understanding that every wire is to be considered "alive," and the prohibiting of all employees, except electricians engaged for that purpose, from operating or tampering with electrical equipment, have been the important factors in reducing electrical accidents and hazards in industrial plants. The practices of several companies in this regard are related.—*National Safety News*, January, 1923.

Transmission, Substations and Distribution

Electrical Developments at Liverpool.—A new 12,500-kw. generator and an automatic substation have recently been placed in operation at Liverpool, England. The 500-kw. rotary-converter automatic substation is the first of its kind to be operated in England. The main features and details of the apparatus are described.—*Electrician*, Dec. 22, 1922.

Economy of Transformer Connections.—R. KORNFELD.—The author compares in this mathematical paper the relative advantages of operating (a) a bank of three single-phase transformers with a fourth single-phase unit as spare, (b) one three-phase transformer with an identical unit as spare, and (c) a bank of three single-phase transformers, operating in V in case of breakdown of one of the three units. The operation of (a) is 20 per cent cheaper than (c) but has 20 per cent higher losses. These losses can be materially reduced by operating in V-connection during periods of low loads. How far this can be carried out without too serious a distortion of the phase voltages resulting in an asymmetrical feeding of three-phase consumers is shown mathematically.—*Elektrotechnik und Maschinenbau*, Dec. 17, 1922.

Causes of Transformer Failures.—S. A. STIGANT.—The faults that most frequently occur in practice, and to which the discussion of the paper is devoted, may be classified as follows: (1) Breakdowns in the magnetic circuit, (2) breakdowns in the electrical conducting circuit, (3) breakdowns in the dielectric circuit, particularly in the oil and major insulation, and (4) miscellaneous structual breakdowns. A study of the records of modern transformer breakdowns over a period of years shows very conclusively that between 50 per cent and 80 per cent of the number of failures are due to short circuits between coils.—*Electrical Review*, Dec. 1 and 8, 1922.

Units, Measurements and Instruments

Determination of the Calorific Value of Liquid Fuels.—H. MOSS and W. J. STERN. — Although accurate comparisons of the calorific values for different fuels may be found by the bomb calorimeter, the absolute values are not obtained with the same certainty. Investigations, explained in detail, have been carried on by the authors of several other methods. Experiments were made with gasoline, benzine, alcohol and paraffine oil at various rates of burning and with different water flows. The heat losses were examined and the accuracy of the instrument determined. —*Engineering*, Dec. 15, 1922.

Recent Developments in Electric Clockworks.—M. LAVET.—A large number of modern electric clocks are described and illustrated schematically, and their features are investigated mathematically. Many of the theoretically ingenious mechanisms do not show a good performance because of the unreliable operation of their auxiliary parts. The paper describes only self-maintained clocks, excluding so-called secondary clocks regulated from master clocks. — *Revue Générale de l'Electricité*, Dec. 2 and 9, 1922.

Illumination

Measurement of Light. — J. W. WALSH.—The fundamental photometric magnitude from the point of view of visual measurement is, according to the author, brightness and not illumination. The photometric unit is one of luminous intensity or luminous flux. Of the two possible systems of definitions based on these respective magnitudes, that in which the unit is maintained seems preferable because it follows the natural order of mental conception. The relation between the flux unit of brightness (the lambert) and the intensity unit (the candle per square centimeter) is pointed out. — *Philosophical Magazine*, December, 1922.

Motors and Control

Motor Drives in Manufacturing Processes. — R. TRAUTSCHOLD. — The modification of existing plants by changing from mechanical to electric drive will in nearly every case bring about results favoring the electric drive. Substituting a motor drive for a mechanical one for the average machine tool will as a rule entail no greater expenditure than will be returned by the economies obtained in one year's operation. The advantages of motor drive as pointed out by the author are reduced friction, flexibility, safety, and lighter building construction. — *Southern Engineer*, December, 1922.

Automatic Plant for Village Lighting.—A small engine-driven generator including a storage battery outfit has been used for lighting villages in England. The operation of this automatic generating unit is entirely controlled by voltage regulation, a detailed description of which is given.—*Electrical Times*, Dec. 7, 1922.

Heat Applications and Material Handling

Driving of Handling Machinery.—H. BLYTH.—The supply of fuel to power plants and gas plants where the energy of the fuel is converted into either electricity or gas for distribution to consumers is best carried out by motor-equipped handling machinery. Typical coal-handling apparatus, such as the telpher system, belt conveyors and bucket conveyors, are described.—*Electrician*, Dec. 29, 1922.

The Production of Carbon Black.—J. J. JAKOWSKY.—The effects of several types of electrical discharges on natural gas has been studied in order to determine the fundamental factors underlying the reactions and their possible influence in the recovery of a greater part of the carbon content of natural gas than is now possible. Present commercial plants using natural gas recover from 0.8 lb. to 1.5 lb. of carbon black per 1,000 cu.ft. of gas consumed, or less than 5 per cent of the total carbon in the gas. Investigations, including apparatus set-up of the various methods so far used with natural gas, are summarized.—*Serial No. 2417 of the Bureau of Mines.*

Electrophysics, Electrochemistry and Batteries

Inspection of Ferrous Materials.—E. A. ALLCUT.—Ferrous materials may be divided roughly into four classes, (1) rolled sections, such as bars, billets, and sheets; (2) tubes and drawn sections, (3) forgings, and (4) castings. Under these headings the author discusses characteristic defects, methods of identification, slag seams and piping, straightness, forging characteristics and various tests such as tensile and impact tests, blowholes, hard spots, etc. —*Canadian Engineer*, Dec. 5, 1922.

Corrosion as Affecting the Metals Used in the Mechanical Arts.—W. H. HATFIELD.—An interesting set of experiments which were conducted to decide upon the relative resistance of typical industrial metals to various corroding media are enumerated. An analysis of various metals which form the subject of experiment is given in tabular form. The mechanical properties, standard acid tests and corrosion tests of the metals are also given in this form.—*Engineer*, Dec. 15, 1922.

Traction

Electric Locomotives for Japanese Government.—Two of the new locomotives for the Imperial Government Railways of Japan are considered. These are equipped with motors specially designed for narrow-gage track. They have high-speed circuit breakers and a new form of electropneumatic control, each feature being described briefly. The locomotives for this railway have been built for 1,500-volt direct-current operation.—*Electric Railway Journal*, Dec. 23, 1922.

Diesel-Electric Railway Car.—One of the first large Diesel locomotives built and run was the thermo locomotive delivered early in 1913 to the Prussian State Railways. This was a 1,000-hp. engine, giving train speeds up to 60 miles per hour. Since that time several engines have been built and have been in successful operation. The main part of the article is devoted to a description of an engine built for the Baden Niederglat Section of the Swiss Federal Railways.—*Engineer*, Dec. 29, 1922.

Automatic and Semi-Automatic Railway Signaling.—H. S. PETCH.—The evolution of railway signaling to meet the demands of safety, and later of traffic capacity, has culminated in the modern automatic and semi-automatic systems. The track circuit, which forms the basis of all modern automatic signaling, is considered in this article, including its modifications to suit electrified lines. Apparatus controlled by track circuits is described, together with additional schemes for its safe operation. The article concludes with a description of some auxiliary apparatus designed to expedite traffic handling.—*Institution of (British) Electrical Engineers*, December, 1922.

Telegraphy, Telephony, Radio and Signals

Vacuum-Tube Amplification.—S. E. ANDERSON.—For sensitivity the author claims that direct radio-frequency amplification should be used. One stage of radio-frequency amplification in a non-regenerative circuit gives about the same sensitivity as a first-class regenerative receiver. Two stages with good transformers will be about five times as sensitive as a simple regenerative circuit, and the regeneration in the amplifier will multiply this by about three. One additional stage of audio-frequency amplification will bring the weaker signals up to a more comfortable volume. Additional stages of audio-frequency amplification—never more than two—should be used only for operating a loud speaker, as they add nothing to the sensitivity of the receiver.—*Q. S. T.*, January, 1923.

Telephonic Repeaters and Long-Distance Telephony.—J. A. COOPER.—The paper reviews the development of long-distance telephony and shows the great improvements effected by the introduction of telephonic repeaters employing thermionic valves.—*Journal of Institution of (British) Electrical Engineers*, December, 1922.

Miscellaneous

Properties of Electrical Insulating Materials of the Laminated Phenol-Methylene Type.—J. H. DELLINGER and J. L. PRESTON.—A comprehensive experimental research has been made upon the principal electrical and mechanical and a few other properties of the laminated phenolic materials. Measurements were made upon materials such as are furnished commercially by several manufacturers. The data collected have been arranged in such a manner as to be conveniently available for reference. A summary-comparison tabulation of the characteristic values of these properties of various materials is reproduced here. Average values for the various properties of laminated phenolic insulating materials are given regardless of grade, make or thickness.—*Technologic Paper No. 216 of the Bureau of Standards.*

CHARACTERISTIC VALUES OF PROPERTIES FOR SEVERAL INSULATING MATERIALS

Property	Bakelite-Dilecto, Grade			Bakelite Micarta, Grade			Condensite Celoron, Grade		Formica, Grade			
	XX	X	Continental Bakelite	32-X and 21-X	323 and 213	21-D	10 and 15	20	M	M-2	P	R
Power factor, per cent	3.6	3.3	6.6	5.1	4.2	9.9	5.1	11.0	5.3	7.7	5.1	7.9
Dielectric constant	5.2	5.5	5.3	5.8	5.9	6.4	6.6	6.8	5.6	5.8	5.8	6.5
Flash-over voltage, radio frequency	9,800	19,800	21,100	20,000	19,700	22,000	21,000	27,800	19,700	20,600	18,300	21,000
Volume resistivity, ohm-cm + 10^8	8,800	520,000	200	9,400	29,900	100	15,100	63	2,200	250	900	60
Surface resistivity at 24 per cent humidity	38,900	445,000	100	3,300	10,400	580	12,500	1,800	600	340	670	340
Surface resistivity at 50 per cent humidity	3,900	4,000	9	900	2,700	130	2,300	275	160	120	300	220
Surface resistivity at 84 per cent humidity	48	6	1	22	30	3	77	13	10	5	34	80
Density	1.34	1.34	1.30	1.35	1.37	1.36	1.41	1.34	1.36	1.34	1.38	1.38
Water absorbed in 24 hours, per cent	.21	1.76	.49	.33	.88	.91	.26	.39	.26	.49	.60	1.22
Ultimate tensile strength, lb. per sq.in.	12,800	17,800	8,700	10,900	16,600	8,900	12,300	7,800	12,600	13,200	18,200	9,900
Modulus of (tensile) elasticity, 1,000 lb. per sq.in.	1,500	2,100	.....	.....	.....	.....	.....	.....	.....	1,950	2,260	.....
Modulus of (transverse) rupture, lb. per sq.in.	18,000	22,700	13,600	16,200	21,400	13,900	15,800	11,100	17,700	17,300	21,400	15,100
Modulus of (transverse) elasticity, 1,000 lb. per sq.in.	1,310	1,900	.....	1,260	1,600	.....	.....	.....	1,270	1,430	1,410	.....
Brinell hardness at 50 deg. C.	40	26	30	34	32	32	35	32	34	41	34	34
Scleroscope hardness at 50 deg. C.	83	64	58	80	76	70	82	82	80	89	82	64
Impact strength, ft.-lb.	0.7	0.9	1.2	0.2	0.8	2.1	0.4	1.0	0.3	0.3	1.5	2.9

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Birmingham Is to Rival Pittsburgh in Electric Power

The Alabama Power Company has started the construction of a substation at Leeds, Ala., which will cost in the neighborhood of $1,500,000 to complete. This station will distribute the power from Lock 12 and Mitchell Dam to the Birmingham district. When the power to be furnished through this station is available, together with the power furnished through the stations at Magella and Bessemer, 371,000 hp. will be provided for the industries of the Birmingham district, which will be the center of a power "loop" supplied from Jackson Shoals, Lock 12, Gadsden, Gorgas and Mitchell Dam.

The power at present available to Birmingham is put at 250,000 hp. Officials of the Alabama Power Company are responsible for the statement that when the station at Leeds shall have been completed Birmingham will exceed Pittsburgh in abundance and constancy of electrical power.

N. E. L. A. Technical Committees Take Up Many Matters

With about two hundred men present from all over the country, the Technical Section committees of the National Electric Light Association were in session at headquarters in New York from Monday to Friday of this week.

Among the important questions before the committees is that of insurance as affecting plant apparatus, a matter which the electrical apparatus committee is considering in co-operation with the prime movers and insurance committees. The question of revision of the N. E. L. A. 1914 handbook on overhead-line construction is up for consideration by the overhead-line committee. It is hoped that the needed revision can be undertaken soon. The transition in power-plant practices to higher steam pressures is engaging the attention of the prime-movers committee, particularly with reference to materials that will successfully withstand the higher temperatures involved. The problems bound up in the trend toward use of extra-high-voltage cable are before the underground distribution committee.

Plans are under way to make a more effective distribution of the reports and other data coming from all the technical committees, and a satisfactory scheme has been evolved, announcement of which is expected in the near future.

On Tuesday evening Executive Manager Aylesworth addressed the members of the various committees at a general meeting. He emphasized the need of engineers directing their attention to the economic and political problems of the industry as well as those purely technical. A well-rounded consideration of all phases of the industry is needed, he held, to enable the engineer to accomplish his work to the best interests of the public and the utilities.

Conference on Abbreviations and Symbols

The American Engineering Standards Committee has called a conference to consider the standardization of abbreviations and of the symbols used in engineering equations and formulas. The conference will meet in the board room of the American Society of Mechanical Engineers, Engineering Societies Building, New York City, at 10 a.m., Tuesday, Feb. 13. It will determine whether unification of engineering abbreviations and symbols should be undertaken and, if so, what the scope of such work should be and has been called in response to requests received from the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the Association of Edison Illuminating Companies. Because of the peculiar nature of the subject and the fact that some of the interested organizations will be unable to have representatives present, the Standards Committee has provided a questionnaire through which such organizations may send information by mail.

Public Utility Commission for Texas Planned

A committee of officials of Texas municipalities has completed the draft of a public utilities bill for Texas, and this bill is now in the hands of members of the Legislature. The measure designates the Railroad Commission of Texas as the public utility commission of the state and increases the pay of its members $1,000 a year each. It provides a tax of one-half of 1 per cent of the gross receipts of the utilities to pay the expense of the commission and provides that any balance in this fund shall go into the state's revenues.

Texas has a "home rule" provision in its constitution, and this bill seeks to preserve to the home-rule cities all their present powers over their utilities while setting up state regulation also. Local utilities have the right to appeal to the Railroad Commission from decisions in the home-rule cities.

House Passes Bill for the Control of Radio

The administration bill to regulate radio communication was passed by the House of Representatives on Wednesday of this week, and early action by the Senate is expected. Briefly, the bill provides that all operators of transmitting stations be licensed. All transmitting stations must be registered. A definite wave length will be assigned by the Secretary of Commerce to each, and the Secretary is to have broad authority to promulgate rules and regulations. Government stations are excepted from the licensing feature but agree to conform to the regulations when engaged in transmitting other than government business. Aliens cannot operate transmitting stations.

A section of the bill dealing with possible monopolies of the wireless business of the nation vests in the Secretary the power to refuse or revoke licenses where a monopoly is threatened.

The bill provides for an advisory committee consisting of men appointed by department heads, radio experts and amateurs, to keep abreast of development and the needs of the wireless industry. A provision for actual expenses of members of this committee when engaged in research work or such other duties as may be assigned them by the Secretary was stricken out.

Consolidated Gas Issue Oversubscribed 300 per Cent

The recent offer by the Consolidated Gas Company of New York City—of which the New York Edison Company, the United Electric Light & Power Company and other electric utilities are subsidiaries—of $15,000,000 of preferred stock to customers and employees, under liberal terms, has been, officials of the company announce, oversubscribed by more than 300 per cent. In other words, nearly 58,000 subscribers applied for slightly more than $48,000,000.

Definite allotment of the full number of shares asked has been made to all who subscribed for from one to six shares. These 33,377 individuals received $4,347,650. Reductions in the number of shares allotted as compared with those subscribed for were made in all other cases, the proportionate amount of the reduction increasing as the number of shares desired increased. Employees of the Consolidated Gas Company and its affiliated companies subscribed for 52,751 shares, their average allotment being 3.21 shares, representing $2,637,550.

Pacific Coast Men Prepare

A. I. E. E. Committee Has Technical Program for Fall Convention Nearly Completed

MEETING in San Francisco on Tuesday of this week, the convention committee of the American Institute of Electrical Engineers having in charge the annual Pacific Coast convention confirmed the tentative decision already announced to hold it at Del Monte, Cal., on Sept. 25 to 28. There will be three half-day technical sessions in the nature of symposiums covering nine outstanding problems now before the electrical industry. Seven of these subjects have been determined upon and are as follows: "Mechanical and Electrical Construction of Modern Power Transmission Lines," "Waterwheel Construction, Operating and Governing," "Experience of Manufacturing and Operating Engineers with Oil Switches," "Practice and Theory in High-Voltage Operation," "Operation of Group Power Sources with the Transformer Tertiary Winding in Operation," "Frequency Problems Arising with Extension of 60-Cycle Practice and Direct-Current Parallel Operation of 45-Cycle and 60-Cycle Power Groups," "Radio Communication Over Power Transmission Networks." The names of the leaders in these symposiums have not as yet been announced.

On Wednesday evening of the convention week the Edison medal will be formally awarded to Dr. R. A. Millikan, and on Thursday evening the formal convention banquet will be held. The afternoons of the convention week will be devoted to recreation in the historic setting of Del Monte and Monterey. On Friday afternoon a special train will leave for Hetch Hetchy, in the Yosemite Valley, when members and their guests will be shown the Moccasin Creek hydro-electric development and all the features of this water project of the city of San Francisco, which is designed to conserve water in the high Sierras and convey it 180 miles to San Francisco, developing 150,000 hp. en route as a by-product.

No stone will be left unturned to make this the most interesting and instructive convention of the Institute thus far held in the West. The convention committee consists of Harris J. Ryan (chairman), Robert Sibley (vice-chairman), R. A. Balzari, W. C. Heston, W. H. Hitchcock, W. P. L'Hommedieu, S. J. Lisberger, H. H. Millar, R. F. Monges and W. B. Sawyer, Jr.

Service at Cost in Milwaukee

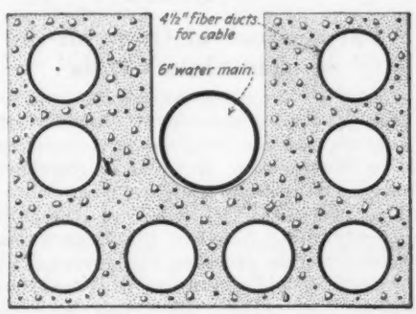
Service-at-cost operation of the electric light and street-railway public utility properties of the Milwaukee Electric Railway & Light Company in Milwaukee and the ultimate purchase of the property by the city are provided for in a contract which the public utilities committee expects to present to the City Council within the next two weeks, according to Fred S. Hunt, chairman of the committee. The contract must be ratified by the Council and authorized by a state law. Then the voters of the city must accept it. The value of the electric light and street railway properties will be fixed and the rate of return to the company agreed upon. The rates to be charged by the company will be fixed by the city, subject to appeal to the State Railroad Commission. Surplus revenues beyond the rate agreed upon will belong to the city.

Three methods are provided by which the city can acquire an interest in the property and ultimate ownership: By investing in the company's securities, by advancing money through a municipal mortgage and by applying the surplus revenues to purchase.

Los Angeles to Install 35,000-Volt Cable

Bureau of Power and Light Will Lay Seven Miles of Underground Conductor with This Rating for Substation Service in Downtown District

SEVEN miles of 35,000-volt cable is to be installed by the Bureau of Power and Light of the city of Los Angeles between its central receiving substation No. 1 and substation No. 2, in the downtown business district, to relieve the badly overloaded condition of the cables now supplying the substations in the business section of the city. Three sections of cable, each 12,000 ft. long, will be installed. Two of these lengths will be of the belted type and the other of the Hochstadter type. Both types will be three-conductor, 400,000-circ.mil lead-covered cable. One of the noteworthy features of this cable is that the conductors will be sector-shape. Both types of cable will be paper-insulated, the thickness of insulation on the belted type being $\frac{2}{32}$ in. and that on the Hochstadter type $\frac{27}{64}$ in. The capacity of the two types will be 12,000 kw. and 15,000 kw. respectively.



CROSS-SECTION OF CONCRETE SUBWAY WITH 6-IN. MAIN IN CENTER

This installation will be watched with interest by engineers throughout the country because it will constitute the largest 35,000-volt underground cable installation in this country if not in the world. There is at present some 33,000-volt cable in operation, but very little cable working at 35,000 volts. For many years it was thought impossible to build cable for operation at pressures above approximately 19,000 volts, but recent successful installations have demonstrated that cables for operation at from 33,000 volts to 35,000 volts are feasible.

An ingenious method of installing the cable to dissipate the heat will be used. Fiber ducts 4½ in. in diameter will be cast in a U-shaped concrete block, and a 6-in. water main will be laid in this concrete trough, as shown in the accompanying illustration. Running water in this main will serve to dissipate the heat more rapidly. The manholes will be constructed with a concrete partition through the center, and four of the cables will pass through one-half of the manhole and four through the other. The water main will pass through the concrete partition. This concrete wall will be an effective fire barrier and will permit of the cables in one-half of the manhole being shut down while workmen are engaged, without danger of accident.

The first shipments of cable will begin to arrive soon, and the installation will be completed about June of this year. Only three cables will be installed at the present time, while the ultimate duct capacity will be eight cables. The cost of the immediate installation will be approximately $300,000.

Tenney Interests to Manage Beverly Company

A controlling interest in the Beverly (Mass.) Gas & Electric Company has been acquired by Charles H. Tenney & Company of Boston, the negotiations having been conducted by John West of Macomber & West, engineers. The company will be managed by the Tenney organization, which also operates the adjacent northern Boston utilities serving the cities of Salem, Malden, Everett and Revere. The Beverly company operates a 1,500-kw. steam generating station which may later be interconnected with the large plant of the Salem company, the nucleus of electrical production in the territory named. A residential business of unusual value is included in the Beverly company's service, which covers a considerable portion of the famous Massachusetts North Shore.

Yadkin River to Take Over Palmetto Properties

Announcement is made by P. A. Tillery, vice-president and general manager of the Yadkin River Power Company of Raleigh, N. C., to the effect that that company is about to acquire all the electric power and light properties now owned by the Palmetto Power & Light Company of Florence, S. C.

Since the organization of the Palmetto Power & Light Company in May, 1917, all of its capital stock has been owned by the Yadkin River Power Company and its properties have been operated under the general supervision of Mr. Tillery. The electric transmission lines of the two companies are also interconnected. Consequently the acquisition of the properties by the Yadkin River Power Company does not mean any change in ownership or in operating supervision. No changes in the personnel of the local managers in the communities served by the Palmetto Power & Light Company are expected to follow the change in ownership. The acquisition of the properties by the Yadkin River Power Company is for the purpose of facilitating the financing of the extensions to properties which are steadily being made.

Telephony Over High-Tension Lines

Westinghouse Electric & Manufacturing Company Tries Out "Wired Wireless" on 66,000-Volt System at Pittsburgh with Much Success

A SUCCESSFUL test of the transmission of radio waves over high-tension power lines was made on Jan. 11 by the Westinghouse Electric & Manufacturing Company before the radio sub-committee of the National Electric Light Association, a committee comprising representatives of some of the larger light and power companies of the United States. The test was carried out between experimental stations in the Colfax and Brunot's Island power stations of the Duquesne Light Company, about 30 miles apart, by engineers of both the manufacturing company and the power company. It was also demonstrated, according to observers, that this system could be used for remote control of all manner of apparatus.

For a long time the Westinghouse company has been working on a method of carrier-current control for use in central power stations and electric railways or other points using high-tension lines, and in this work the Duquesne Light Company has co-operated. Preliminary research on ordinary transmission lines and feeder circuits had indicated that the use of wired wireless was simple and effective on such lines. But when trying out the Duquesne company's lines it was found that its system was so complicated and extensive that many additional problems would have to be solved before it could be used for carrier current.

UNIQUE FEATURES OF SYSTEM

The demonstration, which was made in a small room of the power plant in Colfax where the committee had assembled, showed the feasibility of central-station companies carrying on telephone communication over high-tension lines, which, besides obviating inductive interference, would often save the expense of an additional right-of-way. The new system, which is unique in that it is duplex and operates as does the ordinary telephone, was demonstrated over a 66,000-volt line. When the telephone receiver is unhooked the transmitting station automatically starts up, allowing talk in both directions without any switching. This feature is entirely new in radio, as transmitting and receiving by other methods must be done by switching back and forth, because a station transmitting cannot receive messages. The calling or ringing of numbers is selective and operated by special selector keys which cause the bell to ring only at the station desired. This eliminates distracting code ringing and allows station operators to keep their minds on their work.

The improved system developed by the Westinghouse company has been carefully worked out by C. A. Boddie, radio engineer of the company, and its technical and economic features are now being analyzed by Mr. Boddie, assisted by M. W. Cooke of the Duquesne Light Company.

"Farm Bloc" at Odds on the Muscle Shoals Bills

Lack of harmony among the members of the congressional "farm bloc" over the Muscle Shoals bills is reported from Washington. Some of its members resent the introduction by Representative Dickinson of Iowa of the bill already summarized in the ELECTRICAL WORLD which provides for government ownership and operation of the properties over which there has been so much contention.

"I originally supported the Ford offer, but becoming convinced that it could not be accepted by Congress, I proposed the government corporation plan," said Mr. Dickinson. "I want action that will insure cheaper fertilizer to farmers. Since action on the Ford plan seemed impossible, I thought it time to suggest something else. If the Ford offer could be taken up soon and accepted by Congress, I would support it, but I do not want the whole question of disposing of Muscle Shoals postponed until December, 1923, or later. Many farm bloc members of the House will not vote for the Ford offer."

Representatives of the American Farm Bureau Corporation, which sticks by the Ford bill, now accuse Representative Dickinson of "trying to ride two horses." While some members of the farm bloc in the House, especially Southern Democrats, are standing by Mr. Ford, Senator Norris, who is numbered as one of the Senators supporting the farmers' movement, is quoting as saying that he knows of only two members who are supporting the Ford offer, outside of some Southern Democrats. These are Senators Capper (Kan.), chairman of the bloc, and Ladd (N. D.), a Non-Partisan League man. Senator Norris has proposed an appropriation of $2,000,000 for experimenting in the production of fertilizer at Nitrate Plant No. 1 to establish its possibilities.

Bernard Baruch for Ford's Muscle Shoals Plan

Acceptance of Henry Ford's offer for Muscle Shoals, provided no better offer is available and conditioned on the actual production of nitrogen for fertilizer at the rate of 40,000 tons a year, is recommended in a special report made to the American Farm Bureau Federation by Bernard M. Baruch. A statement issued by Gray Silver, Washington representative of that federation, asserting that the Ford offer would make possible a reduction of three-fourths in the price of nitrogen used as fertilizer has been vigorously attacked by Senator Norris, chairman of the Senate committee on agriculture, who asserts that Mr. Silver is trying to deceive the farmers.

Reorganization of American Public Utilities

A reorganization plan for the American Public Utilities Company, which controls the electric utilities operated by Kelsey, Brewer & Company of Grand Rapids, Mich., has been sent to stockholders. It provides for the elimination of the present 6 per cent preferred stock through its exchange into new prior preferred 7 per cent and 6 per cent participating preferred on the basis of three-tenths share of the prior preferred and eight-tenths share of the participating preferred for each share of the present 6 per cent preferred, with its right to accumulated dividends, and the dividend scrip or accrued dividend notes. Where the present holders of the 6 per cent preferred are not owners of scrip or dividend notes they will be required to pay $7.50 in addition to surrendering their stock for exchange.

The management announces payment of dividends beginning with April 1, 1923, on the new issues, provided that the plan is consummated. No change is contemplated in the common stock, of which $2,995,000 is outstanding, and no additional bonds are to be issued under the plan.

Philadelphia Electric Company to Expand

Stockholders of the Philadelphia Electric Company will receive notice on Feb. 1 that at the annual meeting, which comes in April, they will be asked to approve an increase in the authorized capital stock from the present $65,000,000 to $100,000,000, of which it is proposed to issue an additional $10,000,000 of common stock. This new stock will

be offered for subscription at par pro rata to the holders of common stock, which will make the allotment from 33⅓ per cent as the maximum down to such lesser proportion as it may become by conversion of preferred stock into common in the meantime. There is a total of $15,000,000 8 per cent cumulative preferred, the holders of which have the privilege of converting share for share into common stock, upon which the dividend rate has been established at 8 per cent.

Only common-stock holders will have subscription rights to the prospective issue of new common stock, which is to finance expansion of the existing service facilities to include an increase in rating of 60,000 kw.

Puget Sound Power & Light Takes Over North Coast

Purchase by the Puget Sound Power & Light Company of Seattle of additional electrical properties in western Washington, valued at approximately $3,500,000, was announced and control of the properties assumed on Jan. 20. The properties purchased were those of the North Coast Power Company, consisting of various power systems between Tenino, Wash., and Portland, Ore. The purchase includes the street-railway lines, the light and power plants at Kelso and Chehalis, the power line between Chehalis and Centralia, light and water plants at Tenino and Kalama, the electric railway, light and power plants at Vancouver, Wash., and the electric light and water plants at Hillsboro, Rainier, Beaverton and Forest Grove in Oregon.

This purchase, together with the purchase of the Washington Coast Utilities Company properties announced a short time ago, gives the Puget Sound Power & Light Company control of virtually all of the electrical properties in Western Washington except the Grays Harbor companies and the municipal plants of Seattle and Tacoma.

Consumers' Power Expansion Projects

Preliminary plans for the 1923 power development of the Consumers' Power Company, Jackson, Mich., comprise a new 20,000-kw. plant at Zilwaukee and a new central-station heating plant at Grand Rapids. The Zilwaukee plant, to be built 5 miles north of Saginaw, will have an ultimate capacity of 60,000 kw. Construction plans call for Taylor stokers and a Green induced-draft system with B. & W. boilers to operate at 375 lb. per square inch steam pressure with 250 deg. F. superheat.

The central-station heating plant at Grand Rapids will, according to H. F. Eddy, mechanical engineer of the Consumers' Power Company, supply low-pressure steam with service at 2 lb. and high-pressure service at 50 lb. and 100 lb. per square inch for the downtown section of Grand Rapids. With a steam pressure of 350 lb. per square inch, 250 deg. F. superheat, operating non-condensing through a 1,500-kw. and a 3,000-kw. unit, sufficient steam will be obtainable to heat 600,000 sq.ft. to 1,000,000 sq.ft. of radiating surface. The European design will be adapted for chimney draft by installing the Venturi type of stack.

January Financing Active

DURING the month of January stock, bond and note issues of electric light and power public utilities aggregated $71,451,000. This figure represents an increase of more than fifty million dollars over that reached the preceding month, December, 1922, and of more than twenty million over January's total a year ago. Of the total $33,445,000 was used as new capital, $5,739,000 for refunding outstanding securities and $32,267,000 for both refunding and capital expenditures. Of the twenty-five issues, an unusually large number, the highest single offering was the seventeen-million-dollar issue of the Laclede Gas Light Company. The financing was substantially of a long-term nature and the average rate of return yielded the investor was 6.08.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES JANUARY

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Utah Power & Light Co.	$2,156,000	Twenty-one-year	First mortgage gold bonds	To retire bonds	5	91½	5.70
Long Island Lighting Co.	3,000,000	Twenty-five-year	First refunding mortgage gold bonds, series A	To reimburse for acquisition of properties	6	97½	6.20
Ohio Power Co.	2,000,000	Twenty-nine-year	First and refunding mortgage gold bonds, series B	To provide funds for construction	5	92	5.55
United Light & Railways Co (Mich.)	2,500,000	Fifty-year	Gold debenture bonds, series A.	To retire notes	6	90	6.70
Old Dominion Power Co. (Va.)	500,000	Five-year	First mortgage collateral trust gold notes		6½	99	6.75
Keokuk Electric Co.	400,000	Two-and-one-half-year	Mortgage notes	To pay maturing bonds	6	98½	6.65
Laclede Gas Light Co., (Mo.)	17,500,000	Thirty-year	First mortgage collateral and refunding gold bonds, series C	To retire bonds and for general purposes	5½	96.45	5.75
Community Power & Light Co., (Ark.)	725,000	Fifteen-year	First mortgage collateral sinking fund gold bonds, series B	To provide funds for acquisition of property	6½	97	6.80
Detroit Edison Co.	1,500,000	Nine-year	Convertible debenture bonds	General corporate purposes	6	104	5.95
North Missouri Power Co.	850,000	Nineteen-year	First mortgage and refunding bonds	To provide funds for acquisition of properties and refunding	6½	99	6.60
Brooklyn Edison Co.	15,000,000		Capital stock	To reimburse company for expenditures, etc.	..	Par	....
Wisconsin-Minnesota Light & Pwr. Co.	300,000	Twenty-four-year	General and refunding mortgage gold bonds		7	103	6.75
American Public Service Co. (Ill.)		Nineteen-year	First lien gold bonds		6	93½	6.60
Central Power & Light Co.	3,000,000	Twenty-nine-year	First lien and refunding gold bonds	To pay for properties and other purposes	6½	97	6.75
Denver Gas & Electric Light Co.	383,000	Twenty-eight-year	First and refunding mortgage sinking fund gold bonds of 1911		5	89	....
Indiana Electric Corp.	4,500,000	Twenty-four-year	First mortgage gold bonds, series A*	For additions and other purposes	6	95½	6.37
Oklahoma Gas & Electric Co.	1,000,000	Eighteen-year	First and refunding mortgage gold bonds, series B of 1921.	For payment of floating debt for extensions	6	96	6.37
Power Corporation of New York	1,000,000		Cumulative preferred stock		7	98	7.15
Western United Gas & Electric Co. (Ill.)	570,000	Three-year	Collateral gold notes		6	99	6.25
Memphis Power & Light Co.	5,500,000	Twenty-five-year	First and refunding mortgage gold bonds, series A	To provide funds for acquisitions	5	89½	5.80
Nebraska Power Co.	1,000,000		Cumulative preferred stock		7	98½	7.10
North Boston Lighting Properties	1,500,000	Three-year	Gold notes		5½	99½	5.70
Philadelphia Suburban Gas & Electric Co.	650,000	Forty-six-year	General mortgage gold bonds of 1919	To reimburse for additions	6	96	6.25
Yadkin River Power Co. (N. C.)	4,000,000	Eighteen-year	First mortgage gold bonds	For new properties and to retire gold bonds	5	89	6
Eastern Wisconsin Electric Co.	1,917,000	Nineteen-year	First lien and refunding mortgage gold bonds, series A		6	92½	6.65
Total	$71,451,000						

* Guaranteed principal and interest by Central Indiana Power Company.

Appeals to Federal Courts

Speakers at Meeting of Indiana Public Utility Association Oppose Resort to Them

THE folly of public ownership of utilities, the need for care in rushing into federal courts under the provisions of the Fourteenth Amendment in appealing from decisions of public service commissions, closer co-operation between utilities and the public, the labor situation and many other matters were discussed at the third annual meeting of the Indiana Public Utility Association, held in Indianapolis on Jan. 25.

At a noon luncheon Taylor Groninger, corporation counsel of Indianapolis, and Gov. Warren T. McCray of Indiana gave addresses. Mr. Groninger not so long ago was one of the leaders, under the supervision of Mayor Lew Shank, in seeking legislation to abolish the Indiana Public Service Commission. In his address he commended the work of the commission, but he insisted that state machinery should be used before resorting to the United States courts.

Governor McCray declared he was for the Public Service Commission law and would do all in his power to prevent any amendments to it which would in any way curtail the effectiveness of the work of the commission. He said he did not believe if it came to a real test that any legislature would do away with the commission.

DANGER IN CONSOLIDATIONS

James P. Goodrich, president of the National City Bank of Indianapolis and formerly Governor of the state, made an address at the afternoon session. "It is my opinion," he said, "that if the reins were thrown down and the public told there would be no opposition to repealing the service commission law, not one in ten would want it repealed." He believed, however, that there are elements of danger in large consolidations such as are being perfected now, and he, too, saw danger in too frequent appeals to the federal courts.

B. J. Mullaney, Chicago, director of the Committee of Public Utility Information, told of the experiences of utilities in Illinois with commission regulation. He brought out that in that state it is possible for any city to free itself from the workings of the law by popular vote and go back to the "home rule" system, but that, in spite of agitation, not a city in the state has done this yet.

G. B. Maxwell, former secretary of the Ohio Public Service Commission, said the public must be made to understand the necessity for new capital for extensions of service.

Arthur W. Brady, Howard Dill, T. E. Bohn, S. E. Mulholland and Harry Reid made short addresses.

Customer ownership as the real remedy for economic ills, and not government ownership, was championed by Edward N. Hurley of Chicago, former chairman of the United States Shipping Board, who declared that the electrical industry must provide as much power in the next seven years as it has produced in all its history. "It may seem strange," Mr. Hurley said, "that an industry which is providing 97 per cent of its magnificent service through plants privately owned and operated should feel required to take any serious thought about movements for public ownership, yet the fact remains that in some sections which are not receiving adequate service from their local lighting or street-railway companies and where misunderstandings have created bitterness there is a tendency to harken to those who urge public ownership.

"The federal government's ventures into the field of public management of industrial and public service enterprises demonstrated conclusively," Mr. Hurley went on, "that not more than 50 per cent personal efficiency can be obtained under such management. They demonstrated that not more than 50 per cent of personal interest in the work of the individual can be obtained under this system. I speak advisedly and out of full and intimate knowledge of the facts, and I do not hesitate to tell you that this average of 50 per cent gradually decreases the longer the individual manager or the individual employee continues in industrial service under public management."

C. L. Henry, head of the Indianapolis & Cincinnati Traction Company, was re-elected president. Other officers were elected as follows: Vice-presidents, S. E. Mulholland, Fort Wayne, head of the Northern Indiana Service Corporation, and F. J. Haas, Evansville, head of the Southern Indiana Gas & Electric Company; secretary, Marshall V. Robb, Clinton, an official of the Wabash Valley Electric Company, and treasurer, Charles C. Perry, Indianapolis, president of the Indianapolis Light & Heat Company.

Smith Finds Hard Sledding for Water-Power Scheme

Governor Alfred E. Smith of New York had not up to the time the ELECTRICAL WORLD went to press sent to the legislature his special message on his plan to have the state itself develop and manage its water-power resources, though he had taken occasion more than once to reiterate his views. Strong opposition to this program of public ownership is certain to manifest itself. Already Paul A. Schoellkopf, president of the Niagara Falls Power Company, has notified the Governor that he is menacing the vested rights of that company.

The Governor has made it plain, however, that for the present he is not contemplating disturbing any private developments or taking any steps toward acquiring them for the state through condemnation proceedings in the exercise of the right of eminent domain. Immediate governmental activities will probably be confined to the plans already being carried out on the Mohawk River at Crescent Dam and Vischer Ferry.

A further complication is caused by the suit now pending in the United States Supreme Court, brought by the former Attorney General of New York, to have the federal water-power act declared an uneconstitutional infringement of state rights. Opponents of Governor Smith's policy contend that if the decision goes against the state there will be very little horsepower that the state could develop—at the most 500,000 hp.—since all the chief sources not now in private hands will remain under federal control. On the other hand, should the state win its suit and proceed to acquire power sites on navigable and boundary streams it would confront an expenditure estimated at a billion dollars—a prohibitive sum.

New York State Mayors Act on Water Power

Development of water power by the state is favored by the New York State Conference of Mayors, and its water-power committee has submitted reports of this nature to Governor Smith and the Legislature. The plan favored provides that the State Conservation Commission shall act as an agency of the state to acquire and to utilize the waters within the state and the boundary waters and to develop the water power and sell or lease it to municipalities. The commission would be empowered to purchase, lease or otherwise legally acquire any water power, developed or undeveloped, and any power plants of transmission lines. Water-power rights that have been materially developed could not be acquired under the proposed plan.

The commission also would be empowered to sell electrical energy to municipalities, individuals or corporations, or lease its plants, but it would have to give preference to municipalities. It would be authorized to establish electrical zones, and any municipality within one of these zones could contract for electrical power or energy. In selling the energy to the cities the commission would have to regulate it according to population. The commission would have control over rates, but these would be only sufficient to make the projects self-supporting.

Dominion Defers Action on Deep Waterway

That the Canadian government is not disposed at this time to negotiate a treaty with the American government looking to the deepening of the St. Lawrence waterway to enable ocean-going steamers to reach the Great Lakes, with the incidental project of vast water-power development, has been reiterated from Ottawa. This utterance followed a report from there that Premier King had announced that the Dominion government would consider suggesting to Washington a conference to discuss the report of the Interna-

tional Joint Commission on the St. Lawrence deep-waterway and power scheme. The large outlay of money that would be involved is understood to be the primary reason why the Canadian government does not find it advisable to enter into a treaty in the immediate future.

At the State Department in Washington the statement was made that there had been no fresh correspondence between the United States and Canada on the subject.

The Colorado River Pact

Everything points to the ultimate ratification of the water-power treaty negotiated by representatives of the seven states watered by the Colorado River and its tributaries who met in November at Santa Fé, N. M., under the presidency of Secretary of Commerce Hoover. Some opposition has, however, been reported from Arizona. The Utah State Legislature ratified the agreement on Monday of this week, and the ratifying act was promptly signed by Governor Mabey.

Optimism at Convention of Wisconsin Contractors

The electrical contracting business will be better in 1923 than in 1922, when all previous records were broken, according to L. G. Ross, Superior, president of the Wisconsin Electragists' Association, which met at the Hotel Pfister, Milwaukee, on Jan. 24 for its sixth annual convention. Mr. Ross dwelt on the increasing demand for electrical appliances and comforts in the home.

One of the purposes of the convention, which was attended by 125 members, was carried out in the adoption of a resolution favoring a bill under which no electrical work in the state will be done except by licensed contractors, journeymen or superintendents.

Last year's officers were re-elected as follows: President, L. G. Ross, Superior; treasurer, J. L. Hacker, Sheboygan; secretary, H. M. Northrup, Milwaukee.

Would Have Delaware Developed by Three States

Development of the upper Delaware River for power purposes and as a source of potable water by combined action on the part of New Jersey, New York and Pennsylvania is contemplated in a bill just introduced into the New Jersey Legislature. The bill provides for appointment by the Governor of three commissioners, who would have power to act with similar bodies from New York and Pennsylvania in the preparation of a report recommending a policy to be followed by the three states and the United States in the proposed development project.

"The vast and natural resources of the Delaware River for potable water supply purposes and for the development of water power hae lain dormant principally because it is an interstate boundary," says the explanatory statement attached to the bill. "The advantage of substituting hydro-electric development for high-priced fuel and the necessity of providing adequate water supplies for the increasing population and manufacturing development of the metropolitan section of New York, New Jersey and Pennsylvania all point to the necessity of the preparation of a comprehensive report made under the direction of a tri-state commission such as would be established by the passage of this act by the Legislature of New Jersey and similar acts by the Legislatures of New York and Pennsylvania."

Holiday Illumination of Denver's Civic Center

The brilliantly illuminated scene shown below represents Denver's civic center as it appeared in the holiday season of a few weeks back. Each Christmas tree bore 2,000 lamps, all of which except the large lamp at the top gave either red or green light. Flood-lighting was also used to good effect, as the picture shows. The photograph (a prize one) was taken by O. E. Lindevall, Ossen Photo Supply Company, Denver, and will be copyrighted.

BRILLIANT HOLIDAY ILLUMINATION OF THE CIVIC CENTER OF DENVER

Southern Power Curtailment Program Soon Over

Another power curtailment program instituted at the request of the Southern Power Company among textile mills using its electric power, which went into effect on Wednesday of last week, was suspended on Friday. Lack of rainfall, which caused the request for the curtailment of the use of electric power, was relieved by snow and sleet.

Another Indiana Commission Bill Introduced

A bill to take from the Indiana Public Service Commission jurisdiction over public utilities the property or operations of which are wholly within a city or within one county and confer the jurisdiction on city councils or boards of trustees of towns has been prepared for introduction in the Indiana Legislature. It would abolish by May 1 indeterminate permits that have been issued by the commission to take the place of surrendered franchises, and utilities operating wholly within a city or county would go back under the old franchise contracts, which would stand until legally repealed, modified or canceled. In the cases of utilities that have received indeterminate permits from the commission and did not have franchise contracts with cities, the indeterminate permits would continue for not more than one year after the date of enactment. Within that year such utilities and municipalities would enter into contracts, or, if they failed to reach an agreement, a city council or board of trustees could petition in the circuit or superior courts that rates and other terms be fixed by civil action. The measure provides that there be no appeal from the decision of the trial court.

In this connection an analysis of the operating costs of privately owned and municipal utilities compiled from their annual reports is interesting. It shows that the operating cost of the municipal plants is greater than that of the other class. The municipal utilities pay much more for coal than the private concerns. More also is paid for wages and salaries, which are to some degree mixed up with politics. Out of each $100 of revenue received by electric utilities the privately owned plant spends $71.61 for operating expenses whereas the municipal utility spends $73.44.

Two Views of Fusing Rule

Lively Discussions at Chicago Meeting of Electrical Inspectors Over This and Other Matters

A LIVELY discussion developed at the Thursday session of the Western Association of Electrical Inspectors in Chicago last week over the revision of Rule 23 d of the National Electrical Code, covering fuses for branch circuits. The rule as amended allows fusing of only the underground conductor of a two-wire circuit provided that the grounded conductor be identified in some unmistakable manner. A. L. Eustice of the Economy Fuse & Manufacturing Company raised the question of safety with such a practice when only one fuse in the underground conductor is used, advocating the use of two fuses in series. He showed a number of fuses which had been tested under short-circuit conditions, some with only one fuse and some with two fuses in series. In the discussion which ensued considerable difference of view developed, though it seemed to be the consensus of opinion that the new rule covers a practice that has been followed for a long time without serious results. The discussion was participated in by F. R. Daniel of Milwaukee, J. C. Forsyth of New York and Ben W. Clark of Detroit.

Another subject that aroused much interest was the new Rule 12 b, which calls for an approved weatherproof or rubber insulating cover between outside line wires having less than 5,000 volts between conductors. W. J. Canada called attention to the operating rule of utilities which calls for treatment of such conductors as bare wires because of the unreliability of the insulating materials, which must be subjected to all sorts of weather. Because of the danger involved in men placing unwarranted dependence upon the insulating values of such materials, Mr. Canada took a strong stand against the inclusion of this rule, which is really a restoration of one in the editions of the code previous to 1920. He was supported by F. R. Daniel, J. C. Martin and several others. W. S. Boyd argued for the rule as representing practice that utility companies have been following for a good many years. It was suggested that such a rule should not be included until a committee shall have carefully investigated the subject and determined a reasonable limit, if there is such, for wires on which insulation should be required. In the discussion several asserted that 5,000 volts is not a logical division point as experience has proved that insulating materials now available for conductors carrying up to 2,300 volts are unreliable.

RECODIFICATION OF CODE

Dana Pierce, vice-president of the Underwriters' Laboratories of New York, made a report on the recodification of the code. He indicated the difficulty of getting an arrangement satisfactory to every one, particularly an arrangement that assembles all the material on any one subject in one place. To do this would require an enormous amount of repetition and would defeat the purpose to simplify the code. The arrangement proposed is to place all the material on general subjects at the beginning, following this with an arrangement of the material referring to specific subjects under these subjects in such a way that all the specific material on one subject will be together. This will provide for the fewest cross-references, but will necessitate a complete change in the form of the code.

In connection with the 15-amp. capacity limit in Rule 38 e 2, Ben. W. Clark offered an amendment which restricted the use of gas-filled lamps above 200 watts in boiler rooms. The new Rule 279, showing the number of conductors per conduit size, was altered to improve the ease of drawing wire through conduit without materially damaging the insulation. Opinion as to the number of No. 10 B. & S. wires which could be drawn through a ¾-in. conduit seemed to average four, depending upon the length of run.

Some confusion over the revised Rule 276, relative to the concealed extensions in fireproof construction, seemed to exist until Victor H. Tousley, Chicago, explained that it is for the use of oval cable laid next to the tile and plastered over. This avoids breaking the tile for "fishing in" the regular armored cable, thereby facilitating improved arrangements of fixtures; but these extensions are to terminate in the room where they originate.

A. P. Denton, Association of Electragists International, urged that all inspectors work together with the contractors with the view of assisting and interpreting the recent changes. To do this one of the most effective ways, he said, would be the use of diagrams or charts showing the new rules.

Registration for the convention, a report of the opening sessions of which was printed last week (page 237), totaled 162. The newly elected officers are: President, F. O. Evertz, Columbus, Ohio; first vice-president, W. B. Hubbell, Cincinnati; second vice-president, John Hoeveler, Madison, Wis.; secretary and treasurer, W. S. Boyd, Chicago. The 1923 members of the executive committee are James S. Mahan, K. W. Adkins, W. G. Kelly, W. P. Briggs, W. A. Haig and F. A. Barron.

Electrical Exposition in St. Louis

The St. Louis Electrical Exposition will be held at the Coliseum from March 12 to 17 inclusive under the auspices of the St. Louis Electrical Board of Trade. It is expected that there will be about 150 exhibitors, consisting of both local and nationally known manufacturers and jobbers of electrical equipment as well as many allied industries. Almost all of the available space for exhibition purposes has been contracted for. This will be the first real electrical show to be held in St. Louis for a number of years.

Brief News Notes

Moncton, N. B., Soon to Have Hydro-Electricity.—Moncton, New Brunswick, which expects to be connected with the hydro-electric station at Musquash, in that province, early in February, will be the first city in the Maritime Provinces of Canada to obtain power and light from a hydro-electric source. Arrangements have been made with the Moncton Tramway, Light & Power Company to distribute the energy in the city.

Opposition to Public Service Commission in Missouri.—A bill has been introduced in the Missouri House of Representatives by Frank R. Smith, representative from St. Louis, to curtail the power of the State Public Service Commission by taking away from it the right to abrogate contracts pertaining to fares and rates entered into between cities of more than 75,000 people and the public utility companies operating in them. Other political efforts are being made to abolish the commission or restrict its authority.

Increase in Capital of Public Service Company of Northern Illinois Planned.—Announcement has been made that the directors of the Public Service Company of Northern Illinois will recommend to the stockholders at the annual meeting on Feb. 26 that the authorized capitalization of the company be increased by the addition of 100,000 shares of no-par common stock and $5,000,000 of additional 6 per cent preferred stock. The company, which serves the territory in northeastern Illinois surrounding Chicago, is expanding rapidly to take care of the increased industrial activity in its district.

Electrophysical Research in Arctic Circle.—Donald B. MacMillan, Arctic explorer, expects to set out again for the Far North about the first of next July, this time to establish a permanent scientific station in the northern part of Labrador for the study of terrestrial magnetism and atmospheric electricity. At about 56 deg. north latitude Mr. MacMillan plans to establish two observatories on a running base line about 10 miles long, these observatories to be connected by telephone and each equipped with a moving-picture camera. The cameras will be focused on the same star and will photograph the same ray to determine the height of the aurora.

New Testing Laboratory for Southern California.—The Southern California Edison Company will soon begin the construction of a testing laboratory on its property at Alhambra, near Los Angeles. Here it will install high-tension testing equipment, a transformer test room, insulator testing pits, cranes for handling heavy machinery, a meter department and test room, a general warehouse and general shops. The buildings and equipment will cost more

than a million dollars. It is expected that the new premises will be ready the latter part of the coming summer.

Proposed Bond Issue in St. Louis.—A special bond issue election will be held in St. Louis on Feb. 9 to vote upon proposed indebtedness for municipal improvements. Two projected issues of interest to the electrical industry are that of $8,000,000 for the purchase and installation of equipment for an electric street-lighting system and that of $1,000,000 for the erection of a plant to provide light, heat and power to municipal buildings. The first of the two issues mentioned is subdivided as follows: For double lighting system along all major streets, $3,500,000; for installing electric lamps in place of gas lamps along all streets now lighted by gas, $3,000,000; for lighting all streets now unlighted, for electric lamps in new subdivisions as they are established, and for other future extensions, $1,500,000.

Grand Falls (N. B.) Project.—According to advices from St. John, N. B., the government of New Brunswick is planning to develop the hydro possibilities at Grand Falls, N. B., on the upper St. John River, at the boundary between the Canadian province and the State of Maine. Present plans are to spend about $800,000 in the development. The water-power privileges at Grand Falls are now under lease to the International Paper Company of New York City, but at the expiration of the lease in March the New Brunswick government, it is said, will not renew it, despite reports that the company desires to build a hydro-electric station at Grand Falls to supply cities and towns on both sides of the international boundary. The New Brunswick government has already issued bonds to pay for the Grand Falls project.

Card-Indexing the Engineers—As a part of the program of the War Department to work out plans which will enable it to make most effective use of man power in the event of an emergency, the American Association of Engineers is compiling information as to the qualifications of individual engineers. The association recently sent out what it terms an occupational study sheet. The individual engineer is asked to furnish specified information as to his skill, education, specialties and personal qualifications. The association is confining itself at the start to gathering information from highway engineers. Later it expects to undertake similar work among technical engineers on railroads and among electrical, mechanical and chemical engineers, probably in the order named.

Farmers Fail to Get Large Sums for Wisconsin - Minnesota Right-of-Way.—Awards in the condemnation proceedings of the Wisconsin-Minnesota Light & Power Company, at Chippewa Falls, Wis., have been filed by the land commission appointed to determine the value of the property of eight farmers who protested against the company's plans to route its proposed high-tension line on their land. The amounts granted are very much smaller than those asked by the property owners, who demanded sums up to $2,500 or more, claiming danger from the line and loss to the value of their farms. The basis for the settlement is close to that suggested by the power company. By it farm owners will receive sums varying from $98 to $515 as damages for property included in the right-of-way.

Consolidation in Southern Texas.—The Valley Electric & Ice Company of Brownsville, Tex., a subsidiary of the Central Power & Light Company, has been granted a charter and will take over the recently acquired holdings of the Morrison-McCall syndicate in a number of towns in the Lower Rio Grande Valley. Among the utilities to be absorbed are the ice, water and electric plants at McAllen; the Pharr Ice, Light & Power Company, which supplies Pharr, San Juan and Alamo; the Donna Light & Ice Company, supplying Donna and Weslaco, and the Mercedes Electric & Water Company. The company will also take over the Rio Grande Ice Company plants at Son Benito, Harlingen and Houston. The San Benito light plant, purchased some time ago by the Central Power Company, is still under the direct supervision of that company, but will be included in the list of plants to be merged in the new company.

Hydro-Electric Developments in North Wales.—The extensive scheme for distribution of hydro-electric power throughout north Wales as outlined by the British Electricity Commissioners last year promises to be one of the most noteworthy reorganizations under the electricity supply act. The hydro-electric generation and the high-tension transmission are to be undertaken by the North Wales Electric Power Company, which has already carried on fairly wide operations in north Wales. The controlling interest in this company is held by the Aluminium Corporation, and the main power output is taken by the corporation. This company is in a specially good position to supply power to the slate and granite quarries and other industries in the area and to give a bulk supply to many towns. A new dam at Cowlyd Lake increases the storage capacity of the lake from 700,000,000 gal. to 3,110,000,000 gal., so that the North Wales Power Company has at its disposal sufficient water power for many years.

Mexico to Get More Power from Boquilla Dam.—Important extensions of the power-transmission facilities of the Compãnia Agricola y de Fuerza Electrica del Conchos, formerly called the Mexican Northern Power Company, are to be made as a result of a renewal of the state concession for the operation of the hydro-electric plant and power transmission lines for a period of fifteen years. It is stated by T. G. Mackenzie, representative of the company, that a transmission line will be constructed within fifteen months from the plant at Boquilla, where the company has its great dam, to Camargo and Chihuahua. Other lines must be built during the life of the concession until all the towns and mining camps within a radius of two hundred miles of the plant are supplied with electrical energy. The company is already furnishing power and lights for the cities of Jiminez, Santa Rosalia and Parral and to a number of mining camps. The company is owned largely by financial interests of Toronto.

Associations and Societies

Safety Engineers to Meet.—A joint meeting of the Engineering Section of the National Safety Council and the American Society of Safety Engineers will be held in New York City on Feb. 16. Electromechanical interlocks and electric contacts in elevators will be among the topics.

Wisconsin Utilities Association.—General plans have been announced for the meeting at the Hotel Pfister, Milwaukee, on March 22 and 23, of the Wisconsin Utilities Association, which is a consolidation of the former Wisconsin Electrical and Wisconsin Gas Associations, comprising sixty companies. There will be group meetings of executives, engineers, accountants and merchants.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

New Mexico Electrical Association—Albuquerque, Feb. 12-13. C. E. Twogood, Albuquerque, N. M.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Electric Railway Association—Washington, D. C., Feb. 15-16. J. W. Welsh, 8 West 40th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Pennsylvania State Association of Electrical Contractors and Dealers—Lancaster, Feb. 28.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Tri-State Water and Light Association—Birmingham, April 17-20.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Wills, 403 Slaughter Bldg., Dallas, Tex.

American Society of Mechanical Engineers—Montreal, May 28-31.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Recent Court Decisions

What Constitutes a Public Utility?—In annulling an order of the California Railroad Commission holding a certain water company to be a public utility (McCullagh vs. Commission) the Supreme Court of California said that the mere fact that the articles of incorporation empowered the company to exercise the right of eminent domain did not make the corporation a public utility where the power so reserved was never exercised. (210 Pac. 264.)*

Refusal of Peremptory Instruction on Negligence Sustained. — The Supreme Court of North Carolina, in Springs vs. Tallassee Power Company, has sustained the refusal of the lower court to instruct the jury to find for the defendant on the issues of negligence, contributory negligence and assumption of risk, holding that there was sufficient evidence for the plaintiff to justify the submission of the case for a jury verdict. The action was one for damages because of the death from contact with electricity of a workman engaged in painting one of the power company's towers. (114 S. E. 628.)

Municipal Acquisition of Utility Property. — In rendering its decision forbidding the city of Los Angeles to acquire by condemnation proceedings property rights of the Southern Sierras Power Company acquired by the latter from the Mono Power Company (ELECTRICAL WORLD, Nov. 18, 1922, page 1118), the United States Circuit Court of Appeals said (Mono Power Company vs. City of Los Angeles): "The theory upon which a municipal corporation may condemn and appropriate to a public use the property of a private corporation engaged in serving such municipality or its inhabitants is that the private corporation is using its property for a public use for a profit and that the municipality has the right, in the interest of itself and its inhabitants, as an economical administrator of municipal affairs, to perform this public service itself and thus eliminate the profits of the private corporation. This is not the case. The defendant is not rendering any public service to the city of Los Angeles and does not propose to do so. Defendant's transmission and distributing lines do not extend into the city of Los Angeles, and it has not proposed so to extend them. The property of the defendant has been appropriated to the public use of other counties, municipalities, incorporated cities and towns and the inhabitants thereof, and not for the city of Los Angeles or its inhabitants." The court further expressed its inability to see how if by reason of the "public use" to which the defendant's property was under law appropriated defendant could not sell, lease or encumber its property without the authority of the state commission, this property could be condemned by another corporation in another county for a public use in that other county.

Rate-Fixing Powers of Illinois Commission. — In Illinois Bell Telephone Company vs. Illinois Commerce Commission it was sought to enjoin the commission from proceeding to prevent the enforcement of rates filed with it by the telephone company. The Supreme Court of Illinois found that while the commission has no authority to make rates for a public utility in the first instance, as that right lies with the utility, the commission, in order to prevent unjust discrimination, undue preferences and extortionate rates and charges, is charged with the duty of establishing just, reasonable and uniform rates, and in a hearing it is the commission's duty to establish the rates proposed, in whole or in part, or others in lieu thereof which it shall find to be just and reasonable. Where the commission ordered rates permanently canceled, but did not enter any finding as to whether they were reasonable or as to what would be reasonable rates, it was held that injunction would not lie to prevent the commission's interfering with the charging or collection of the scheduled rates, the remedy by mandamus being adequate to compel the performance of the duty imposed by the law. (137 N. E. 449.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

New York Telephone Rates Revised.—As the outcome of an inquiry concerning the rates of the New York Telephone Company conducted by the Public Service Commission of New York since November, 1921, affecting rates in all portions of the state, and also the case involving rates in New York City brought before the Public Service Commission, Second District, in 1920, the existing commission has handed down a final order revising rates and charges for telephone service throughout the state, effective March 1. The state-wide case was instituted by the present commission on its own motion. The New York City case was brought by the New York Telephone Company on a petition to increase exchange rates $16,000,000 in New York City. The order just issued provides for a revision of all rate schedules in New York City, effects decreases for small users estimated at $250,000, increases rates for large users to about $2,500,000, decreases flat rates in effect in Brooklyn by about $75,000, increases the long-haul interzone toll rates in Greater New York and makes a decrease in toll rates to suburban areas adjoining Greater New York, with consequent elimination of the federal tax on such messages, estimated to be $300,000. Complaints from about 135 up-state communities are adjusted. The valuation of the property of the New York Telephone Company is placed at $167,153,634 in Greater New York and at $68,531,357 in the rest of the state. On this valuation a 7 per cent return is allowed.

Unprofitable Extensions Not Obligatory.—The Connecticut Public Utilities Commission has denied a petition asking that the Danbury & Bethel Gas & Electric Light Company be forced to extend its transmission line 2,000 ft. for the benefit of the petitioners. The commission, regretting that it has not the legislative authority to permit another utility ready and able to supply the service to enter the territory, in which the one named has charter rights, nevertheless has asserted that an electric utility should not be required to extend service into a sparsely built-up community in which there are no prospects of development or growth of population in the near future and where the probable cost of extending the line, maintaining it and furnishing the required service would be greatly disproportionate to the probable return.

Condemnation of Hasty Construction.—The rivalry between the Eastern Wisconsin Electric Company and the Badger Public Service Company as to which should have the right to serve the town of Calumet (ELECTRICAL WORLD, Dec. 2, page 1237) led to the following declaration by the Wisconsin Railroad Commission: "In deciding this case the commission has given no weight to the fact that actual construction of lines in this town has gone forward. It might be well, however, to indicate that the commission regards the attempt to secure or maintain advantage by hasty and uneconomical construction work while a matter is being litigated as inconsistent with the proper conception of the duties and obligations of a public utility. The law provides an orderly means for the settlement of territorial disputes, and any attempt to forestall such orderly procedure is bound to be futile in the long run."

Linking Electric Plants.—The modern tendency in the electric utility field toward linking together separately operated electric light and power companies for their mutual benefit and that of their customers was recognized by the Public Service Commission of Pennsylvania when it granted to the Metropolitan Edison Company permission to acquire control of a local power company by stock purchase, despite objections that existing contracts would be vitiated, rates increased and electrical energy diverted from the charter territory of the local company. It was shown that the consolidated company would have financial resources sufficient to develop and utilize a vast quantity of water power that was being wasted, and, declaring that "wherever practicable the utilization of water power is to be encouraged as a conservation measure," the commission refused to see anything wrong in the consolidation.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Arthur W. Berresford Resigns

Arthur W. Berresford, vice-president of the Cutler-Hammer Manufacturing Company for more than fifteen years, has resigned his office owing to a need that he feels for rest from business pursuits. Mr. Berresford has long been a prominent figure in the electrical industry not only as one of the chief executives of the company which he has served for twenty-two years, but also as an active partaker in association affairs. He began his professional career with two years of general engineering work. Then he became associated with the Riker Electric Company as designer and subsequently with the Ward Leonard Electric Company in charge of testing and designing work. In 1898, with two others, he purchased the assets of the Iron Clad Rheostat Company from the receiver in whose hands it was and formed the Iron Clad Resistance Company, of which he was made vice-president and manager. In 1900 this company was purchased by the Cutler-Hammer Manufacturing Company and he entered the engineering department. In 1901 he was made superintendent, in 1902 secretary and three years later general manager. It was in 1907 that he became vice-president as well as general manager. In May, 1920, Mr. Berresford was elected president of the American Institute of Electrical Engineers, having previously served as its vice-president and also as manager. Mr. Berresford has, besides, been president of the Electrical Manufacturers' Club, and during the war he was elected chairman of the General War Service Committee of the Electrical Manufacturing Industry and was as well chairman of the general war service committee of the Associated Manufacturers of Electrical Supplies. Mr. Berresford was born in Brooklyn, N. Y., in 1872 and is a graduate of Cornell University. He plans to devote time in the immediate future to work in the various associations of which he is a member.

A. W. BERRESFORD

Alabama Power Company Appoints Division Managers

W. M. Stanley has been made manager of the eastern division of the Alabama Power Company, with offices at Anniston, Ala.; C. B. McManus has been made manager of the western division, with offices at Birmingham, and O. K. Seyforth has been made manager of the northern division, with headquarters at Huntsville.

Tenney & Company Elect New Executives

Isaac S. Hall has been elected a vice-president of Charles H. Tenney & Company, Boston. Mr. Hall, who is a native of Stillwater, Minn., was educated at Yale University. He entered the bookkeeping department of the Malden (Mass.) Electric Company in 1909, later becoming cashier and assistant manager. From Malden he went to Boston as office manager for the Tenney organization and in 1920 was appointed auditor. Clifford E. Paige, formerly manager of the Worcester (Mass.) Gas Light Company, was also elected a vice-president of the company.

Byllesby Organization Elects New Vice-Presidents

Halford Erickson has been elected a vice-president and director of the Byllesby Engineering & Management Corporation, in charge of operation of all subsidiary utility properties of the Standard Gas & Electric Company. Mr. Erickson for many years was a member of the Railroad Commission of Wisconsin, and for two years, 1915 and 1916, he was the chairman of that commission. For the last five years he has been vice-president of the Louisville Gas & Electric Company.

Announcement was made at the same time of the election of four new vice-presidents of H. M. Byllesby & Company, all of whom have had long experience with the companies composing the Byllesby organization. They are R. G. Hunt, Joseph H. Briggs, B. W. Lynch and M. A. Morrison. Mr. Hunt, who has been in the organization for nineteen years, has for the past seventeen years been assistant to the vice-president in charge of operation of the Byllesby Engineering & Management Corporation; Mr. Briggs, who has been with the organization for fourteen years, has for the last four years been manager of the bond department; Mr. Lynch, of eighteen years' service with the organization, was formerly general auditor, and Mr. Morrison, who has been in the corporation's service fourteen years, was assistant secretary and assistant treasurer.

A. N. Kemp Resigns

A. N. Kemp, vice-president in charge of finance of the Southern California Edison Company, has resigned to accept the office of a senior vice-president of the California Bank of Los Angeles. Mr. Kemp has been associated directly with the Southern California Edison Company since the merger into that company of the Pacific Light & Power Corporation in 1917, having served with the latter company as treasurer and controller for many years prior to the consolidation of the two companies. His duties with both of these corporations have been directly in connection with the companies' financing and sale of their securities, and particularly, in directing the very extensive and successful activities of the Edison company in interesting its consumers and the public generally in becoming partners in the business.

A. N. KEMP

By education Mr. Kemp is a banker. Although a native Californian, he spent several years in study and experience in Great Britain and New York, returning to California in 1905. His concentration of effort in the financial field has developed in him a remarkable grasp of the financial situation, which will be of great value to the institution with which he is now associated. His resignation became effective Feb. 1.

W. P. L'Hommedieu has been appointed manager of the newly organized central-station division of the San Francisco district office of the Westinghouse Electric & Manufacturing Company, with which office he has been connected for a number of years.

P. W. Koch New President Chicago Electric Club

Paul W. Koch, who was recently made the president of the Electric Club of Chicago, served on the board of directors for three years and as vice-president during the past year. Mr. Koch became associated with the Chicago City Railways Company in 1907, where he served until 1910 as assistant division engineer of substations. He then became a salesman in 1911, after spending a year in development work for the Thomas J. Grier Company, manufacturer's agent for oil circuit breakers. It was in 1915 that he purchased this company, organizing it under the name of Electrical Sales Engineers, Inc. In 1919 the name of the organization was changed to Paul W. Koch & Company, and this firm has been functioning as manufacturers' agents ever since. The assumption by Mr. Koch of the president's chair brings to that office a man well versed in the aims of the club.

Clyde H. Loughridge, consulting electrical engineer, has opened offices in Cleveland, Ohio. Mr. Loughridge has had nineteen years' experience in electrical design and construction both as an electrical engineer and as an electrical contractor.

William P. Creager, chief engineer and a director of the Northern New York Utilities, Inc., has been elected a vice-president of the corporation. Mr. Creager is also vice-president and chief engineer of the Power Corporation of New York.

H. C. Spoden, formerly of Chicago and more recently with the Electric Lighting Supply Company and the Pacific States Electric Company of Los Angeles, is now assisting E. P. Markee, district manager of the Edison Lamp Works of the General Electric Company.

W. W. Trench, assistant secretary of the General Electric Company, has been appointed secretary of the various committees which will administer the Charles A. Coffin Foundation, the income from which is to be employed in making various awards for meritorious service in the electrical field.

R. B. Harvey, formerly connected with the Westinghouse company and the Litscher-Lite Corporation, has been appointed sales manager of the farm light and power division of the Matthews Engineering Company, Sandusky, Ohio. Mr. Harvey's experience covers all phases of the farm light and power business from manufacturing to sales.

H. H. Walker, president of the Electrical Contractors and Dealers' Association of Los Angeles and one of the leading electrical contractors of southern California, has been appointed representative on the advisory committee of the California Electric Co-operative Campaign by the Southern District, California State Association of Electrical Contractors and Dealers.

H. B. Cannon, formerly agent of the San Joaquin division of the Pacific Gas & Electric Company at Newman, Cal., has been made electrical superintendent on the North Bay division, with headquarters at Vallejo.

New Manager of Alabama Power Has Had Wide Experience

Eugene A. Yates, who has been appointed general manager of the Alabama Power Company, as was announced in the Jan. 27 issue of the ELECTRICAL WORLD, has been for years in close touch with the development and growth of this company and other power companies in the South. Mr. Yates was

E. A. YATES

chief engineer of the company from 1912 to 1914 in the construction of Lock 12 and has been connected with the company as a consulting engineer since that time. From 1914 to 1918 he was vice-president and chief engineer of the T. A. Gillespie Company, contractor, New York City, in charge of construction work, involving dams, subway construction, bridges, etc. Since 1918 he has been engaged in consulting work in New York City, mainly along the lines of hydro-electric plants and power developments and studies, which included a study of power companies and power situations in the entire Southeast. Mr. Yates was born in Elizabeth, N. J., in 1880 and was graduated from Rutgers College in 1902.

A. W. McConnell of the Electric Construction Company has been elected president of the Little Rock (Ark.) Electric Club.

H. W. Reed, who recently was connected with Landers, Frary & Clark, is now connected with the Illinois Electric Company in Los Angeles.

John Fordyce of Butternut, Wis., has acquired a controlling interest in the Glidden Light, Power & Water Company, heretofore owned by Fred Boheim of Ashland. Mr. Fordyce is now president of the organization and John C. Kneifel has been installed as manager of the local plant.

F. L. Hunt, chief engineer of the Turners Falls Power & Electric Company, has been elected vice-president of the Engineering Society of Western Massachusetts.

P. M. Duncan has severed his connection with the Allis-Chalmers Manufacturing Company, Milwaukee, to accept a position as method engineer with the Western Electric Company, Hawthorne plant, Chicago.

Robert G. Kittle has resigned as sales manager of the Laundryette Sales Company to enter the New York office of the Benjamin Electric & Manufacturing Company, under Basil Kodjbanoff. Mr. Kittle has been connected with the electrical industry since 1907, when he entered the employ of the Adams-Bagnall Electric Company. He left that organization in 1916 to go with the Luminous Unit Company as district sales manager.

F. D. Phillips, who for twenty-two years has been actively connected with the electrical industry, has been appointed manager of the H. C. Roberts Electrical Supply Company of Syracuse, N. Y. His introduction to the industry was in 1900, when he accepted a position with the Electric Appliance Company of Chicago. In 1906 he removed to St. Louis to take charge of the city sales department of the Wesco Supply Company, and seven years later he was made general sales manager. Mr. Phillips became sales manager of the Central Telephone & Electric Company of St. Louis in 1916. Soon afterward he was elected vice-president of that company and in 1918 he became president. During the sixteen years that he was connected with the electrical industry in St. Louis he was particularly active in all its co-operative efforts, including the Jovian Order and the St. Louis Electrical Board of Trade.

Obituary

David Cochrane, inventor of steam specialties, died on Wednesday, Jan. 24, at his home in Wissahickon, Philadelphia. Mr. Cochrane, who was seventy-three years of age, died of septic poisoning after an illness of about a week. He was born in Scotland and came to this country when he was thirty years of age. Soon after he arrived here he became connected with the Harrison Safety Boiler Works, which is now known as the H. S. B. W.-Cochrane Company.

Robert Edes Chetwood, who has been in charge of all engineering and development work of the Western Union Telegraph Company since 1913, died on Friday, Jan. 26, at his home in Elizabeth, N. J., after an illness of a few weeks. Previous to his association with the Western Union Company in 1910, Mr. Chetwood was connected with the engineering department of the American Telephone & Telegraph Company. He was born in Elizabeth and was a graduate of Lehigh University.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Proper Marking of Nameplates*

What This Accessory Means, for Example, on the Electric Motor—Abuses that Have Crept Into Its Use

By Bernard Lester
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

NO MANUFACTURER of a complete piece of machinery for general use can conduct his business with any degree of permanent success without marking each of the individual units which he manufactures, with its capacity and principal characteristics, in a complete and honest fashion. If the manufacturer does not do this, he makes it difficult for the purchaser of the apparatus to use it intelligently, or he may at times even go so far as intentionally or unintentionally to misrepresent the actual characteristics of the apparatus.

Complete and correct nameplate marking is therefore of primary importance, and this is particularly true in the case of motors which are purchased and sold again in their original form or resold mounted upon some particular machine or appliance which the motor is intended to drive. In such instances the second party, who may not be so familiar as the manufacturer with characteristics of the motor, is usually involved, and unless the nameplate clearly defines the motor capacity and motor characteristics, there is much likelihood of misconception in some form.

In addition to the interest of the motor manufacturer, resale agent, machine manufacturer and user, there is also the interest of the central power station on whose circuits the motor is usually attached. The central station is distinctly interested, either from the point of view of revenue in the sale of energy or from the point of view of the motor characteristics which may affect the operation of his system or the safety of his customers. Horsepower rating is to some extent used as a measure of energy consumption, and we are all familiar with the central-station motor service rules adopted by the National Electric Light Association.

*A paper presented before the Electric Power Club, at its Asheville (N. C.) convention, Oct. 30, 1922.

What Nameplates Are For

The principal uses of nameplate markings upon motors may be summarized briefly as follows:

1. To instruct the user or resale agent as to the correct operating character of the motor.
2. To furnish sufficient information for the successful connection of motor to the supply current.
3. To supply the user of the motor with information of identification for purposes of duplication or repair.

In addition to these factors, the individual marking of a motor with a serial number or some other form of individual identification is often used by the manufacturer of the driven appliance or machine to distinguish the identity of the complete driven unit. Motor serial numbers are therefore used to some extent, as the serial numbers of driven units and records are kept in this way by the manufacturer of the appliance.

In the case of standard fractional-horsepower alternating-current motors, the following nameplate markings have been adopted by the Electric Power Club as "recommended practice": (a) Manufacturer's type and frame designation; (b) horsepower output; (c) time rating; (d) temperature rise; (e) r.p.m. at full load; (f) frequency; (g) number of phases; (h) voltage; (i) full-load amperes.

In the interest of economy these nameplate markings should obviously be reduced to a minimum. At present they apply to motors from 0.05 hp. to 0.75 hp. Upon the small series-wound motors which are used for sewing machines, vacuum cleaners, electric drills and other appliances an elaborate marking such as this is probably entirely unnecessary. There seems to be no way, however, under present conditions of eliminating any of these items from the standardized line of fractional-horsepower motors unless some designation based on the Electric Power Club standard and recognized as such be substituted for the time rating and temperature rise. This, however, is a subject which should be seriously considered in the future in connection with fractional-horsepower motors. Perhaps the nameplate information itemized above may appear to some as being unnecessarily elaborate, but a careful analysis of each item will show that its elimination would cause considerable difficulty. Obviously a number of other characteristics could be added, but the effort should be toward simplification.

Nameplate Abuses

In connection with the nameplate-marking situation certain abuses have arisen, and there has been on the part of the motor manufacturers a laxness of practice. These irregularities may be summarized as follows:

1. Incomplete nameplate marking.
2. Substitution of symbols for figures in the nameplate markings or other forms of designation.
3. Acquiescence in the practice of customers taking off nameplates and substituting therefore nameplates incompletely marked, incorrectly marked or both.

In regard to the matter of incomplete nameplate marking, motor manufacturers generally have been slow in adopting the practice recommended. This standard as a "recommended practice" was last revised over five years ago, so that there is probably little reason for any manufacturer not to adopt the present nameplate marking on his product.

In this connection an interesting analysis was made about two years

ago of the nameplate marking of all motors mounted on motor-driven appliances at a prominent electrical show. Obviously this did not include motors used in connection with vacuum cleaners, electric drills, etc., since the motor usually in such instances loses its identity. There were a total of thirty-two motor-driven appliances exhibited. Of these all but five appliances had nameplates incompletely marked. Only on five motor nameplates were the temperature rating and time rating marked, and on most of the nameplates no space was provided for such marking.

In some instances motor manufacturers have been induced to substitute for the horsepower some symbol or letter which has little or no meaning to the user of the machine. On some occasions the purpose of this has been to get around existing central-station rules. In addition to this some motor manufacturers have been induced by appliance manufacturers to increase or decrease the horsepower marking on the nameplate to enable the manufacturer to give the purchaser of the machine the impression that the machine is driven either by a large motor with reserve capacity or by a small motor which requires less energy than that ordinarily used to operate similar devices. These, of course, are "tricks of the trade" which simply start trouble and ultimately reflect on all motor manufacturers, as well as establishing practices among appliance manufacturers which are unethical and do not promote honest and stable business. The removal of nameplates by resale purchasers for the purpose of substituting a nameplate which in any way misrepresents the capacity or performance is certainly something which should be not only discouraged but discredited in every way possible.

BUILT-IN MACHINES

One of the most difficult situations which arise in connection with nameplate marking is in connection with special motors. Often motors of special characteristics are purchased and built directly into the driven appliance, so that it is impossible to detach them and use them as general-purpose motors. In such instances there does not seem to be any objection to special nameplate marking, provided that there is no misrepresentation, as the motor in these cases is called on only to operate the complete machine and its identity is tied up with the machine itself. Appliances will probably be built more and more with the motor an integral part of the driven appliance. Such a tendency will simplify problems in connection with nameplate marking.

Motor manufacturers are often called upon to furnish their motors with special nameplates which may include the name of the manufacturer of the resale motor-driven appliance upon which the motor is to be mounted. This practice is obviously an expensive one unless a large number of motors is involved, but as long as the nameplate expresses the characteristics and does not misrepresent there seems to be no logical objection to such a practice.

Fighting the High Cost of Small Orders

The Experience of One Manufacturer of Electrical Equipment in Penalizing Small Orders by Adding a Dollar to the Regular Price to Cover Loss

BY J. C. BELDEN
President Belden Manufacturing Company, Chicago

FOR the past two years competition in our line has been so keen that we have felt it necessary to investigate every possible avenue through which business might reach us which would result in a loss. We found among other things that we were receiving a great many orders, principally from jobbers, calling for a few ounces up to a few pounds of wire, many of these orders amounting to from 50 cents to $5.

We are organized to do a wholesale business. The average value of our orders should be about $100, and it is unless we take a lot of small orders that we should not take. We make a varied line of material, and in order to avoid costly mistakes it is absolutely necessary that each order be separately entered with a full description, and possibly reference to specifications, that will safeguard our factory from mistakes. We have ascertained that it costs about $1.62 each for all the paper work connected with putting an order into the factory, getting it out and billing it to the customer.

It is perfectly obvious that we could not enter an order under $5 at regular prices without incurring a loss. In addition, many of these fractional orders put up for jobbers at a few cents a pound profit, on which we incurred all the expense of preparation, and which in many cases we shipped direct to the customer, were billed out by the jobber at prices netting them a margin far exceeding our profit even before we deducted the special cost of handling a small quantity. We, therefore, determined to make an extra charge of $1 on every order under $5 and announced this program by sending the notice to our customers which is shown here.

We gave our department managers authority to waive this charge to customers whose general business is such that we can afford to include the handling of such orders with their larger ones. But we have made some mistakes and made charges against customers who were entitled to receive this service as an accommodation. Some of our customers accept our position as a reasonable one,

RESULTS OF ADDING PENALIZING CHARGE TO SMALL ORDERS

	Charged on Invoices as Small-Quantity Charge	Credited on Account Complaints
May	$212.00	$31.00
June	234.00	20.00
July	138.00	19.00
August	163.00	17.00
September	116.00	7.00
October	112.00	18.00
November	140.00	9.00
December	97.00	2.00

IMPORTANT!

Beginning April 1, 1922, a Small Quantity Charge of $1.00 will be added to all orders amounting to less than $5.00 net, not including spool or prepaid transportation charges.

Our business is organized to manufacture and sell economically in large quantities. Owing to the large and diversified stocks carried we receive many small orders, which cannot be handled as cheaply as if organized to do a retail business.

We have accurately figured the cost of handling these orders, from the time they are entered until the goods leave the factory, and find that we must make this Small Quantity Charge, which makes up in part only the loss incurred on same.

Belden Manufacturing Co.,
Twenty-third Street and
Western Avenue
CHICAGO

METHOD OF ANNOUNCING SMALL ORDER CHARGE

Others, however, insist that it is the result of pure greed and that we are trying to gouge them. We have received a number of threats to cancel our name from the list entirely.

The accompanying table shows results since this policy was adopted.

It is somewhat difficult to draw exact conclusions from these figures, but we feel that while the money derived from this charge is inconsiderable, we have prevented the receipt of hundreds of small orders that would have cost us money to fill and, what is of much greater importance, would have clogged the wheels of the machinery that gives service on our big orders.

We believe that the jobber who is conscientiously trying to reduce the waste in the distribution of electrical goods should look upon this policy when adopted by a manufacturer with favor and endeavor to apply the same principle in his own selling in so far as possible. This has not generally been the case, however, in our experience.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Dr. S. S. Wheeler Discusses the European Market

DR. S. S. Wheeler, president Crocker-Wheeler Company, who has just returned from Europe, where he was a delegate to the International Electrotechnical Conferences at Geneva, does not see much of a market in the near future for American electrical motors in Europe. "The European," he pointed out in an interview with a representative of the ELECTRICAL WORLD, "still insists on individual treatment and service in his every desire and need. It seems inbred in all continental Europeans, at least, to conduct themselves and their business on an individual basis—the antithesis of 'mass production.' Thus in their own manufacturing and also in their purchasing they look at things the same way."

Dr. Wheeler pointed out that there is not much production in France, a little more in England and practically none in Italy, but that Switzerland can produce enough heavy machinery for their needs and is willing to meet the individual wishes. The great variety of odd and unusual voltages in use is another deterrent to American manufacturers now selling successfully at a profit in some of the European markets. Italy, however, is going ahead fast on long-distance high-tension transmission construction, but, according to Dr. Semenza's statement to Dr. Wheeler, even with this large new development is not able to come to standard voltages because the new transmission lines are connected up with existing systems.

In addition to all this Dr. Wheeler points out that with the further conditions of the high-tariff wall around the United States and the depreciated currency in Europe, it does not look like much of an immediate market in Europe for American equipment, except for specialties which Switzerland cannot supply. On the other hand, lack of production in Europe should open even wider other world markets which Europe in pre-war days supplied so freely.

Speaking of business conditions in this country, Dr. Wheeler said that he expects sound progress to continue. His own company shows an activity of 100 per cent over two years ago at this time and 50 per cent over this time last year, with every evidence of continued increase in business demands.

Road Conditions Hamper Farm Lighting-Set Sales

Sections of the country in the grip of severe winter weather are at present difficult territory for salesmen trying to cover such districts, road conditions hampering both travel and shipments of ordered equipment out of local stocks. The demand for farm lighting sets has held up remarkably well during the past few months. One representative field agent covering six states reports that the quota for his office sales was exceeded in December, ordinarily a dull month in this line, and the outlook for 1923 is excellent. Prices are firm at present, and it is believed that if a good volume of business is forthcoming in the next few months, fairly stable quotations will be in order.

English Electrical Exports in 1922 Gained £17,000,000

The report of the British Board of Trade for December completes the figures for English exports and imports for 1922. The total British exports for the year were £720,496,426 against £703,399,542 in 1921 and £1,334,469,269 in 1920. Although the total fell far short in money value of 1920, yet there is a rise of £17,000,000 as compared with last year, and it has to be remembered that there has been a steady fall in values since 1920. Imports of all kinds were £1,003,918,124 against £1,085,500,061.

The December imports of electrical goods and apparatus were valued at £204,558 against £177,643 for November, and electrical machinery at £58,076 as compared with £72,539. The exports of electrical goods and apparatus were £7,306,578 and of electrical machinery £4,151,735, a grand total of £11,458,313. This compares with £17,779,092 in 1921 and £14,272,479 in 1920. In actual money value it will be seen there is a drop of £6,000,000 on last year, but how much of the drop is due to decreased values it is not easy to say. Another factor which entered more largely into the figures of 1921 than into those of the twelvemonth just closed is the effect of the sales of surplus stock. Much of the stock which accumulated during the closing period of the war and which was sold in the year 1921 must have gone out of the country.

Imports of electrical goods and machinery totaled £2,711,591 last year compared with £2,639,998 in 1921 and £3,157,964 in 1920.

The Metal Market

Domestic Copper Buying Is Strong at 14.87½ Cents—Sales for the Week Estimated at 30,000,000 Lb.

Domestic copper buying is strong and the price has advanced to 14.87½ cents for deliveries to the end of June. Most inquiry is for February, March and April shipments, with a little also for May. Indications are that another buying movement has begun in earnest, and it is estimated that sales during last week totaled 30,000,000 lb. Foreign sales are improving. Domestic orders generally are known to be in large amounts.

NEW YORK METAL MARKET PRICES

	Jan. 24, 1923 Cents per Pound	Jan. 31, 1923 Cents per Pound
Copper		
Electrolytic	14.62½	14.87½
Lead, Am. S. & R. price	7.50	7.75
Antimony	6.75	7.00
Nickel, ingot	36.00	30.00
Zinc, spot	7.00	7.00
Tin Straits	38.62½	40.00
Aluminum, 98 to 99 per cent	23.00	23.00

Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, 16.38 to 16.63 cents net, mill; brass wire, 19.5 to 21.5 cents; copper sheets, 22.25 cents; copper rods, 15.5 to 15.75 cents; brass rods, 17.25 to 21.38 cents; sheet brass, 19 to 20.63 cents.

Commercial Inquiries.—The Bureau of Foreign and Domestic Commerce answered 7,822 electrical inquiries during June, 1921, and July, 1922; 13,843 during July, 1922, and January, 1923, and 567 during the week ended Jan. 13. 1923.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

VOLUME of orders received during the week indicates a steady demand for wire, conduit, armored cable and high-tension equipment. The amount of business being placed by the jobbers is heavier than for some time, and further indicates throughout the country that this year's business may be expected greatly to exceed that of 1922. Deliveries in New England and the Middle West are held up because of snow and storms, and salesmen in the rural districts are hindered by difficult travel. Business in materials for central-station extensions and interconnections promises to be fair. Prices generally are firm and stocks are improving.

New York Improvement in manufacturers' and jobbers' business continues; stocks are being improved each day and the volume of materials entering into new residences and commercial buildings is slightly larger. Conduit stocks are very low and there is little relief in sight. High-tension equipment for central stations has received some additional attention during the last few days, and the prospects for the spring are very bright. Prices generally are firm.

Chicago Although jobbers report a steady week of electrical trade, the main volume was not so brisk as the first three weeks of the year. Most jobbers consider this lull merely as a slight reaction to the excellent start of the year's business, and they do not express much apprehension for future trade. Building construction is constantly requiring a steady volume of wiring material, which is rapidly moved from dealers' shelves. Stocks are in good condition, since carry-overs for 1922 were greater than in 1921. Price trends on wire and conduit are still inclining upward. The lamp market is experiencing its regular active winter demand and supplies are still normal. High-tension apparatus is reported brisk. One company received an order for 66,000-volt outdoor substation equipment for New England. Another sold one 33,000-volt, 600-kw. substation for New England, two 44,000-volt, 1,500-kw. substation for the Northwest and three 22,000-volt, 300-kw. substations for the Middle West.

Boston Business holds up well despite a seasonal lull in heavy supply movement and appliance demand. Building activities are vigorously maintained. Jobbers are buying more for stock than for some time. Public utility earnings are gaining rapidly and house-wiring campaigns are meeting with striking success. Prices are firm except in wire, which is weakening as a result of local efforts to move accumulated stocks. Deliveries in northern New England are greatly handicapped by snow and ice, and sales representatives report travel as extremely difficult in the more remote interior sections. Throughout the trade in New England the expectation is that this year's business will be of surpassing volume. The outlook is favorable for increased purchase of transmission-line material in the near future for interconnection work.

Atlanta The past week witnessed a very severe sleet and wind storm throughout north Georgia and the western Carolinas, which resulted in considerable damage to telephone and telegraph lines and in somewhat less damage to distribution systems and high-tension transmission lines. Replacements made necessary by this damage should stimulate sales of pole-line material in the sections affected. Service has been restored, and all utilities report their conditions as nearly normal. Municipal activities in South Georgia and Florida are on the increase, manufacturers reporting very satisfactory business in generating equipment up to 100 kw. capacity. This will, of course, be reflected in the increased demand for construction materials in these sections. Electrical jobbers had anticipated a good season for air heaters, but, owing to the unusually mild weather to date, the volume of sales has been far below expectations. Good stocks are on hand. Stocks are being brought up to normal and satisfactory business is generally reported by all electrical jobbers and dealers.

Cleveland Industrial equipment orders dominated the week. Motors were not especially active, although inquiries were received for quotations on the larger types. Conduit sales have been in good volume and the demand for armored cable continues. Radio jobbers and dealers have enjoyed a favorable week and stocks are in good shape.

Storage-Battery sales are sluggish, radio dealers reporting a departure from their use in radio sets. Batteries for use in motor cars have received some slight stimulation with the placing of spring orders. The building program promises much activity for fixture dealers and central stations. Congestion continues to hamper deliveries, but with the railroads promising relief it is expected that traffic movements may be expedited within the week. Retail sales are satisfactory. Appliances particularly are selling without much apparent effort, and dealers forecast an unusual spring. Collections are fair.

Pittsburgh Prices generally are more settled, and fluctuations are less noticeable. Construction of residences and industrial building continues in fair volume. Wire is still selling actively with low stocks. The main difficulties which are troubling manufacturers and jobbers in this district are those induced by the conditions in the coal fields and the car shortage.

St. Louis Electrical jobbers report business for the month of January better than anticipated and considerably over the average for the past twelve months. One jobber reports the sale of 500 4,000-volt lightning arresters to a central station, and orders from salesmen on the road show a splendid demand for merchandise. The annual review of business in St. Louis for 1922 places the total volume during that period at $1,326,793,000, which is an increase of 10.4 per cent over that shown for the year 1921. An increase appears in almost all lines, but the greatest increase was shown by the electrical industry, which shows a total volume of $50,000,000 in 1922 against a volume of $35,000,000 in 1921, or an increase of 43 per cent.

St. Paul-Minneapolis The amount of orders during January is as heavy as in the average months of 1922. Some jobbers expected a slump. There seems to be plenty of money and some are planning big campaigns in the spring. Supply of small conduit is very short. Inquiries show big municipal and central-station business in spring. Demand is still big for radio. Prices show slight decline.

New Orleans January's electrical business is better than last year's and better than the average in January. Furthermore, the prospects for the entire year are considered remarkably good because of the large building activity in this city and section. A number of large structures have been begun or are about to be begun. The new electrical license law, which went into effect Jan. 1, is weeding out the inefficient contractors. New Orleans has been troubled with a very large number of these during the last few years.

Denver Jobbers report reasonably satisfactory business for first month of new year, with indications that late spring and summer will be record-breaking. Stop appliance sales, excepting flat irons are slow. A recent increase of $10 on most washing machines has not retarded sales, although demand is not so brisk as several months ago. New interest is being taken in sales of farm light and power plants through reasonable terms based on pre-war prices and certain allowances. Sales organizations for these plants are being reestablished in light of favorable prospective business. Credit conditions in agricultural communities are holding back this business

Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fifteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Radio, Rectifiers
and Heaters

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Storage Batteries	Farm Lighting Plants	Electric Tools
New York																		
Demand	Act.	Sdy.	Sdy.	Slow	Slow	Slow	Sdy.	Slow	Sdy.	Spy.	Sdy.	Sdy.	Act	Sdy.	Sdy.	Act.	Sdy.	Sdy.
Supply	Nml.	Hi.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Dec.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm
Chicago																		
Demand	Act.	Sdy.	Act.	Sdy	Sdy.	Slow	Slow	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Act.	Slow	Slow	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Boston																		
Demand	Act.	Sdy.	Act.	Slow	Slow	Slow	Slow	Slow	Sdy.	Sdy.	Act	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Dec.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Atlanta																		
Demand	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Slow	Act.	Slow	Act.	Act.	Act.	Act.	Slow	Act.	Act.	Act.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
Cleveland																		
Demand	Act.	Sdy.	Act.	Slow	Slow	Slow	Slow	Slow	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Act.	Slow	Sdy.	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Dec.	Firm	Firm
Pittsburgh																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Low	Act.	Slow
Supply	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
St. Louis																		
Demand	Sdy.	Sdy.	Sdy.	Act.	Slow	Slow	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Act.	Act.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Slow	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
New Orleans																		
Demand	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Slow	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Sdy.	Slow	Sdy.
Supply	Low	Nml.	Low	Nml.	Low	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.
St. Paul-Minneapolis																		
Demand	Act.	Slow	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Act.	Slow	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Salt Lake City																		
Demand	Act .	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Sdy.	Slow	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Hi.	Nml.	Nml.	Low	Hi.	Nml.	Nml.	Nml.	Hi.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Inc.	Firm	Dec.
Denver																		
Demand	Act.	Act.	Act.	Slow	Slow	Act.	Act.	Slow	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Slow	Sdy.	Act.	Slow
Supply	Nml.	Nml.	Low	Low	Nml.	Low	Low	Low	Hi.	Nml.	Low	Nml.	Hi.	Hi.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm
San Francisco																		
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Slow	Act.
Supply	Hi.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml
Price trend	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Inc.	Firm	Firm
Portland-Seattle																		
Demand	Sdy.	Slow	Act.	Act.	Act.	Sdy.	Slow	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Slow	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm

along with other staples. However, the outlook is an optimistic one with continued good weather and an extensive building campaign under way.

Portland-Seattle Electrical jobbing business for January has been very satisfactory. Seattle jobbers report business 100 per cent better than a year ago. There is a general feeling of optimism regarding prospects for the coming season. Reports from contractor-dealers, however, are more variable and generally not so optimistic. The lumber industry is particularly active at this time, and building is moving along in a very satisfactory manner. Copper wire has advanced 5 per cent during the week, and further advances are in prospect on all steel and iron products as well as copper. A slight advance is reported on glass insulators and loom is up 10 per cent. Shortage in conduit is still acute. Farm lighting plants are moving very slowly at this time and no marked improvement is expected before fall. The demand for electric tools is small, and jobbers have practically discontinued handling storage batteries except for radio work. The present market is primarily supplied by agents of the battery manufacturers.

San Francisco Export business, particularly with China and Mexico, showed remarkable improvement during January. Healthy buying conditions in the Bay Cities is reflected by San Francisco's response to its "community chest" drive. Lower prices on such staples as porcelain and boxes are evidence that 1923 promises to be stiffly competitive, reproducing in its turn the conditions which prevailed in the East several months ago. Cotton, copper and steel are firm, with every indication of advancing. Farm plants are slow, supply normal and prices firm. Most country agents apparently have drifted away to new fields because of poor prospects

Salt Lake City The development of railroad extensions, iron and coal projects and hotel facilities in southern Utah continues. This points to a steadily improving business in Utah and adjacent territory. The mild weather has passed and a spell of real winter now prevails. The effect has been to slow up retail trade. Electrical dealers are now giving much attention to pending washer campaigns scheduled to start early in March. There is a disposition to make more extensive preparations than has been the custom for several years past. Prices generally are firm.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

American Engineering Acquires Standard Crane & Hoist

The American Engineering Company, Philadelphia, manufacturer of stokers and marine auxiliaries, announces that it has taken over the Standard Crane & Hoist Company and the patent and manufacturing rights to mono-rail electric hoists as manufactured by the latter named company.

The American Engineering Company has reorganized its No. 1 plant to accommodate the work of building and testing the hoists. H. S. Valentine, formerly chief engineer of the Standard Crane & Hoist Company, is directing sales and supervising manufacture of the hoists.

Holslag Wins Welding Decision in Patent Office

A decision of the United States Patent Office issued recently and signed by the three examiners in chief affirms the priority of a welding machine invention to Claude J. Holslag of the Electric Arc Cutting & Welding Company, Newark, N. J., on all counts.

The patents refer to apparatus for and a method of using alternating current for arc welding by means of a transformer. The patents were issued June 3, 1919. The first decision in Mr. Holslag's favor was given in May, 1922, and the affirmation of that decision was rendered Jan. 12, 1923.

Westinghouse's Order from Japan

The Tokyo Electric Light & Power Company, which supplies the city of Tokyo, Japan, with electrical energy, has recently placed with the Westinghouse Electric & Manufacturing Company a large order for generating and switching equipment to be used in extensions now being made to its system. The order covers switchboard, switching and generating equipment to be used in four of the Tokyo Electric Light Company's stations.

Contractors Feature Convenience Outlets in Wiring Campaign

A co-operative house-wiring campaign under the auspices of the Malden (Mass.) Electric Company and the Malden-Everett-Melrose Association of Electrical Contractors has just been opened on the basis of emphasizing convenience outlets rather than the ordinary outlets for lighting service. For an initial payment of $2 on a contract guaranteeing a payment of $2 per month for eleven additional months, or $22 cash on completion of the work, the customer receives a wall outlet in the kitchen, a floor outlet in the dining room and another in the parlor, giving the opportunity to use a flatiron, floor lamp, toaster, vacuum cleaner or washing machine.

Return post-card folders describing the offer were mailed to 40,000 residential occupants at the beginning of the campaign Jan. 18, and thirty inquiries were reecived on the first day. Eight of these "leads" averaged service requests involving outlays of $100.

Gifford-Wood Appointment

Directors of the Gifford-Wood Company, Hudson, N. Y., manufacturer of elevating and conveying machinery, have announced the appointment of Joseph A. Boucher to the position of sales manager. Mr. Boucher's first few years with Gifford-Wood were spent in the company's offices in Hudson, much of his time being devoted to engineering work. Eventually he joined the sales force and was assigned to the New York City office. He is now stationed in Hudson.

Wakefield Brass Appointment

F. I. Wilson has recently joined the sales organization of the F. W. Wakefield Brass Company, Vermilion, Ohio, manufacturer of "Red Spot" hangers. Mr. Wilson was formerly with the appliance department of the Erner Electric Company, electrical jobber, Cleveland. He graduated from the University of Indiana in 1917.

Hart & Hegeman Promotions

Monroe Guett, for some time factory manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn., has been elected vice-president of this organization, retaining his former title also. Mr. Guett has been in the employ of this company for about thirty years. John R. Cook, who has been in the sales department for about seven years, has been appointed assistant sales manager, with headquarters at Hartford.

American Wiremold Appoints New York Sales Manager

C. C. Sibley has been appointed district sales manager of the American Wiremold Company, Hartford, Conn., with headquarters at 27 East Tenth Street, New York City. Mr. Sibley will handle the company's business in northern New Jersey and the lower Hudson Valley in addition to the metropolitan area.

Cleveland Electrical League's Program

The Electrical League of Cleveland has announced its plans for co-operative development work for the year 1923. This activity will be organized under four departments, specializing in the promotion of wiring, lighting, appliances, and industrial power and heat. According to the program:

The wiring section plans to distribute wiring suggestion booklets to all who take out permits for dwelling buildings, to encourage builders to bring plans to the league for expert advice on wiring and lighting the home, to maintain through a special representative, the point of contact with architects, house building contractors and wiring contractors, to endeavor to influence appliance manufacturers to distribute room plans like or similar to those prepared by the league, to continue the work started by the public information committee of compiling under one cover data and drawings which beyond any question of a doubt will result to the benefit of the entire industry, to encourage the installation of convenience outlets in old homes by the aid of a wider distribution of room plans and through editorial copy and display space in daily newspapers, and to co-operate with lighting section to improve lighting in all new buildings as well as buildings previously constructed.

The lighting section plans to conduct three store lighting exhibits, to employ a special lighting representative to conduct store lighting exhibits and to endeavor to influence architects and wiring contractors to provide for better lighting installations, to distribute lighting suggestion booklets to present and prospective home owners, who take out permit to erect dwelling building, to conduct a home lighting contest, to co-operate with builders of electrical homes, and to assist in promoting better lighting in offices, shops and factories.

The appliance section plans to conduct an eight weeks' campaign on the value of the clothes washed in the home, to conduct an eight weeks' campaign on the value of the vacuum cleaner in the home, to conduct an eight weeks' campaign on the value of the ironing machine in the home, to continue the services of a range representative to try to make each range owner a satisfied user, and to co-operate with the wiring committee in the distribution of room or home wiring plans that will prompt the installation of additional outlets in buildings which are to be constructed for the future use of electrical appliances.

The program for the industrial power and heating section has not been completed.

Uehling Instrument Appoints New Jersey Representative

Announcement is made that Royal E. Terhune has been placed in charge of the northern New Jersey sales territory of the Uehling Instrument Company, Paterson, N. J., manufacturer of "CO_2 recorders" and other power-plant equipment. Mr. Terhune was formerly associated with the Uehling Laboratories and is therefore well qualified to co-operate with power-plant operators on the subject of power-plant economy.

Edison Appliance Offices Moved

The New England district offices of the Edison Electric Appliance Company, Inc., have been moved to 99 Bedford Street, Boston. C. P. Myrick, district sales manager, states that increased business required the change and that in the new quarters double the former floor space is being occupied. Samples of all lines produced by this organization will be carried for display purposes at the new offices.

Betts & Betts Sales Change

The Betts & Betts Corporation, 645 West Forty-third Street, New York City, manufacturer of refillable-fuse plugs, bell-ringing transformers, radio apparatus and motor-driven controllers, announces that H. O. Klug, whose appointment to the territory formerly covered by F. Maples, consisting of western Pennsylvania, Ohio, Michigan, eastern Indiana, northern Kentucky and West Virginia, was announced in the ELECTRICAL WORLD for Jan. 13, has resigned owing to illness in his family. He is succeeded in the position by William J. Gannan.

States Company's Orders Gained 100 per Cent in 1922

A decided improvement in business was experienced during 1922 by the States Company, Hartford, Conn., according to H. J. Blakeslee, treasurer, who said that the demand for testing apparatus for both domestic and foreign use is increasing.

The total sales of the company were about 100 per cent better in 1922 than in 1921. Two and one-half times as many test tables were sold in 1922, and orders received during January maintain the recent improvement in this class of business.

Sales to Australia, Mexico, Canada and China feature the company's more recent foreign business. The winding department is being relocated near the main factory and the number of persons employed is about double the force required a year ago. A new automatic cut-out for series lighting circuits has lately been put into regular production, and the company is developing other apparatus to facilitate testing with special reference to portability. Sufficient orders for radio transformers are on the books to occupy the company until spring. The demand for phantom loads and other equipment used in meter testing in the field is also encouraging.

Master Electric Company's New Building in Dayton, Ohio

The Master Electric Company, Dayton, Ohio, manufacturer of motors, has recently moved into its new offices and factory at First and Sears Streets, Dayton, Ohio, where greatly increased floor space, enlarged facilities and strengthened organization enable it to increase production in order to take care of its growing business.

NEW OFFICES AND FACTORY OF THE MASTER ELECTRIC COMPANY

The Mine & Smelter Supply Company, with branches in Denver, Salt Lake City and El Paso, has taken over the representation of the Wilson Welder & Metals Company, 132 King Street, New York City, for the States of Colorado, Utah, Nevada, Wyoming and New Mexico and for western Texas for Wilson plastic-arc welders and Wilson color-tipped welding metals.

The Ledox Storage Battery Company, 314 Bergen Street, Brooklyn, recently organized, has arranged for the construction of new works at 76 Fourth Avenue. Initial operations provide for the manufacture of plates and castings, with assembling department at the company plant, and other manufacture carried out under contract. Extensions in manufacturing facilities are planned. J. D. Moulton is president and O. W. Larson secretary and treasurer.

The Westinghouse Lamp Company, 165 Broadway, New York City, with plant at Bloomfield, N. J., has authorized Stone & Webster Inc., 147 Milk Street, Boston, engineers, to prepare plans for new works in the vicinity of the present factory, primarily for the manufacture of bases for incandescent lamps. They are estimated to cost $500,000, with machinery.

The Western Electric Company announces purchase of a tract of land comprising 55 acres on the Kearney Meadows in New Jersey, south of the Lincoln Highway, adjoining the large plants of the Federal Shipbuilding Company and the Ford Motor Company, having a frontage on the Passaic River of about 1,600 ft., upon which it will immediately begin the erection of factory buildings. It is the intention of the Western Electric Company to establish on this land an Eastern factory to supplement the manufacturing operation now carried on at its Hawthorne plant in Chicago.

The Frank E. Wolcott Manufacturing Company, Hartford, Conn., has secured a charter to manufacture electrical equipment and appliances, the authorized capital being $50,000. The incorporation is a continuance of the business previously conducted by Mr. Wolcott. At present part of the work is let out to contract.

James. A. Condon, Inc., has taken over the business formerly conducted at Third and Arch Streets, Philadelphia, by Howard W. Read. The new company, which will specialize in steam, electrical and contractors' equipment, is headed by James A. Condon, who for twenty-one years was with Frank Toomey, Inc. The company has a warehouse at 1114 Frankford Avenue.

The Electrical Dealers' Supply Company, 162 West Randolph Street, Chicago, manufacturer of electrical fixtures and equipment, has awarded a contract for a three-story-and-basement plant, 100 ft. x 200 ft., to cost $250,000, including equipment. Simon Frankel is president of the company.

The Allis-Chalmers Manufacturing Company, Inc., Milwaukee, Wis., announces that its board of directors has declared a dividend of $1 per share on the common stock, payable Feb. 15, 1923, to common-stock holders of record at the close of business Jan. 24, 1923.

Foreign Trade Notes

HYDRO-ELECTRIC DEVELOPMENT IN NEW ZEALAND. — Proposed hydro-electric developments in New Zealand, according to a schedule drawn up, *Commerce Reports* states, involve a total expenditure of £12,902,000, covering a period of ten years, reaching a maximum of £2,023,000 in 1925. It has been necessary to postpone for a couple of years the commencement of the main works at Lake Waikaremoana, owing to financial conditions in New Zealand, and to hold over a number of the smaller developments in the South Island until power boards have been appointed to handle the question of distribution. Transmission lines and projects to be developed will be pushed ahead in order to make the supply of electricity as general as possible up to the capacity of the headworks at each site. The mains from Lake Coleridge will be extended into Otago and North Canterbury, and those from Mangahao will reach to Wanganui and Napier. These are in addition to lines already under construction.

AUTOMATIC PREPAYMENT TELEPHONES TO BE INSTALLED IN FRANCE. —The French administration of posts and telegraphs, according to *Commerce Reports*, has awarded a contract to a company, recently organized, for the installation of an automatic system. This company, which controls the rights of the so-called taxiphone for France, is to receive the exclusive concession for twenty years to establish and operate in France telephone booths fitted with automatic prepayment telephones. The company plans ultimately to extend its operations to all parts of the republic, but for the present it will install only about one thousand stations. The name and address of the company which has received the contract may be obtained upon application to the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., or any of its district offices.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in South Africa (No. 5,155) of a rotary wheel for cutting cotton, to be operated on alternating current at 200 volts.

An agency is desired in Spain (No. 5,179) for electrical machinery, pumps, ventilators, etc.

Purchase and exclusive agency is desired in Spain (No. 5,183) for miscellaneous electrical supplies for installations in homes or offices, motors up to 20 hp. or 25 hp., wire, incandescent bulbs and electrical novelties.

Purchase and agency is desired in Poland (No. 5,190) for electrical goods, machinery, supplies and apparatus.

Purchase or agency is desired in Chile (No. 5,193) for transmitting and receiving radio apparatus suitable for various distances up to several hundred miles.

An agency is desired in South Africa (No. 5,209) for railway and industrial equipment, electric meters and other machinery suitable for the South African market.

An agency is desired in Poland (No. 5,225) for electric generators, motors and current-measuring apparatus, copper wire and cable of all sizes, supplies for electrical installations, telephone and telegraph apparatus, electric fire-alarm and burglar-alarm systems and parts, and electric railway block signals.

EQUIPMENT FOR MORWELL (AUSTRALIA) POWER SCHEME. — Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until April 28 for transformers and spares (Specification No. 23/9), for the Morwell power scheme. Tenders will also be received until March 15 for motors, starters and isolating switches (Specification 23/7), for the Morwell power scheme. R. Liddelow is secretary.

DEMAND FOR SMALL ELECTRIC LIGHT PLANTS IN PORTUGUESE EAST AFRICA.—In spite of the intense business depression prevailing throughout Portuguese East Africa and its hinterland of the Eastern Transvaal and Rhodesia, Consul Cecil M. P. Cross, Lourenço Marques, states that there is a moderate demand for small electric lighting plants suitable for farmhouses. Practically all of these in use are of American manufacture. A strong potential demand exists throughout Portuguese East Africa, as only the cities of Beira and Lourenço Marques have central electric plants. Cheaper plants operated by kerosene or some cheap fuel would better meet the requirements of the markets, owing to the high price of gasoline. The two distributing centers are Beira and Lourenço Marques.

New Apparatus and Publications

CENTRIFUGAL PUMPS.—The De Laval Steam Turbine Company, Trenton, N. J., is distributing a bulletin and instruction manual describing and illustrating the "De Laval" type "F" small single-stage centrifugal pumps.

RADIO HORN.—The Bristol Company, Waterbury, Conn., has placed on the market a new "loud speaker" horn, known as "Audiphone, Jr.," which is used for radio receiving.

ARC WELDING.—The Electric Arc Cutting & Welding Company, Newark, N. J., has developed a new device for direct-current arc welding.

BENCH DRILL.—A new "Dunmore" portable sensitive bench drill has recently been placed on the market by the Wisconsin Electric Company, Racine, Wis.

ELECTRIC FANS.—The Century Electric Company, 1,827 Pine Street, St. Louis, has brought out a new induction-type single-speed, alternating-current fan, in 9-in. and 12-in. sizes. Bulletin No. 32 issued by the company describes and illustrates its alternating-current and direct-current fans.

PRESSURE PIPE. — Catalog No. 22 issued by the American Spiral Pipe Works, Chicago, Ill., describes and illustrates the "Taylor's" spiral-riveted pressure pipe.

RADIO APPARATUS. — The Whiteland Manufacturing Corporation, Washington Avenue from Sixth to Seventh Avenue, Long Island City, N. Y., is distributing two leaflets describing the "Whiteland" loud-speaking radio apparatus and loud-speaking telephone equipment.

RADIO HORNS. — The Betts & Betts Corporation, 645 West Forty-third Street, New York City, is distributing a leaflet describing its fiber radio horn.

ACCESSORY FOR TESTING MICROSCOPE STANDS.—An interference accessory for testing microscope stands and fine adjustments has been developed by Adam Hilger, Ltd., 75a Camden Road, London, N.W.1.

LIGHTING FIXTURES.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, is distributing serial No. 401, which calls attention to the use of the "Curtis Adapter" for indirect lighting without ceiling fixtures.

SHOW-WINDOW LIGHTING.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has issued serial No. 402, covering its No. 33 show-window floodlight.

OIL CIRCUIT BREAKERS.—A new line of circuit breakers, type F-10, designed primarily for industrial applications, such as textile, cement and flour mills and in mines, has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

FUSE PLUG.—A new fuse plug, "H & H," of the renewable-fuse type has been placed on the market by the Hart & Hegeman Manufacturing Company, Hartford, Conn.

New Incorporations

THE SOUTH GEORGIA PUBLIC SERVICE COMPANY, Albany, Ga., has been incorporated with a capital stock of $10,000, with privilege of increasing it to $3,000,000. The company proposes to secure electricity from the plant of the Georgia-Alabama Power Company on the Flint River, above Albany, which it proposes to distribute in Tifton and neighboring cities.

THE MARTHASVILLE (MO.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $4,000 to generate and distribute electricity and to deal in electrical supplies, etc. The incorporators are F. H. Suhre, H. W. Duebbert, E. H. Koch, O. F. Dickmann and R. H. Morhaus.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME. — The Cumberland County Power & Light Company is considering changing its system in Portland from direct to alternating current.

BOSTON, MASS.—The North Boston Lighting Properties, 201 Devonshire Street, has issued $1,500,000, part of the proceeds to be used for extensions and improvements to its plants and systems at Malden, Everett and vicinity.

PITTSFIELD, MASS. — The Pittsfield Electric Company contemplates building a pipe line from its Silver Lake power plant to the center of the city in the spring, to continue the heating service which it has been furnishing to the business blocks in North Street. The cost is estimated at $70,000.

SALEM, MASS.—Electric power equipment will be installed in the ice and cold-storage plant to be erected by a new company now being organized by P. A. Sweeney, 246 Essex Street, to cost about $150,000.

UXBRIDGE, MASS. — The Uxbridge Worsted Company is planning to build a new power plant. The equipment will include two 500-kw. turbo-generating units and 1,500 hp. in boilers. George P. Carver, Inc., Boston, industrial engineer, will design and construct the plant.

PROVIDENCE, R. I.—The annual report of the Metropolitan Park Commission presented to the General Assembly contains a recommendation that funds be appropriated for lighting the Barrington Parkway in East Providence with electricity.

NEW MILFORD, CONN.—Electric equipment will be installed in the proposed refrigerating and packing plant to be erected by the Confederated Abattoirs Corporation, to cost about $90,000.

Middle Atlantic States

GOUVERNEUR, N. Y.—The Oswegatchie Light & Power Company is considering the installation of a 600-hp. engine for use in case of emergencies.

LE ROY, N. Y.—The Genesee Light & Power Company, Batavia, has acquired the property of the Le Roy Hydraulic, Electric & Gas Company. A transmission line will be erected from Batavia and extensions made in the local system.

MADRID, N. Y.—The St. Lawrence Transmission Company, Potsdam, has applied to the Public Service Commission for permission to establish an electric plant in Madrid.

NEW YORK, N. Y.—The Navy Purchasing Officer, South and Whitehall Streets, has received authority to purchase 144 porcelain post insulators (N. S. A. req. 112) and 110 storage-battery testing outfits (N. S. A. req. 453).

PLATTSBURGH, N. Y.—The Lake Champlain Pulp & Paper Company has acquired a site on the Saranac River near here, where it contemplates building a hydro-electric plant to cost about $75,000. It is estimated that about 1,500 hp. can be developed.

POTSDAM, N. Y. — The St. Lawrence Transmission Company has petitioned the Public Service Commission for permission to extend its transmission line from Potsdam to Gouverneur.

CHATHAM, N. J.—The installation of electrically operated pumping machinery at the municipal waterworks is under consideration. Extensions will be made in the lighting system on North Summit Avenue.

MEYERSDALE, PA.—Plans are being prepared by the Meyersdale Electric Light, Heat & Power Company for extensions to its power house, including the installation of new equipment.

NOXEN, PA.—The Noxen Electric Company, recently organized, plans to install a local system.

PHILADELPHIA, PA.—The Quaker City Rubber Company, Milnor and Comly Streets, will build a one-story power house at its plant.

PHILADELPHIA, PA.—The Art Loom Rug Company, Mascher and Westmoreland Streets, will erect a power house at its plant, to cost about $50,000.

PHILADELPHIA, PA.—The Beswick & Clay Company, Twenty-sixth and Callowhill Streets, will build a one-story power house in connection with extensions to its plant. M. Ward Easby, 1814 Chestnut Street, is engineer.

PHILADELPHIA, PA.—Bids will be received by the Department of Wharves, Docks and Ferries, Room 211, Municipal Pier, No. 4, until Feb. 9, for electric wiring and other work at the Girard Pier, No. 3, North Delaware River.

PHILADELPHIA, PA.—The Philadelphia Electric Company has called for bids for the erection of a substation at Trenton Avenue and Somerset Street. Plans are being arranged for an increase in capital from $65,000,000 to $100,000,000, part of the proceeds to be used for extensions.

PITTSBURGH, PA.—The West Penn Power Company has authorized plans for the initial unit of its proposed hydro-electric plant on the Monongahela River, Cheat River Valley, W. Va., to have a capacity of 50,000 hp. The cost is estimated at $3,500,000.

SCRANTON, PA.—Plans are under consideration by the Scranton Commercial Association for the installation of an ornamental lighting system on Wyoming Avenue between Lackawanna Avenue and Green Ridge Street.

SELLERSVILLE, PA.—The Pennsylvania Power & Light Company has acquired property of the Excelsior Light & Power Company. Extensions are contemplated.

BALTIMORE, MD.—The Washington, Baltimore & Annapolis Electric Railway Company is planning to supply electricity for lamps and motors in a number of small villages along its lines. This service will be furnished by the Annapolis Public Utilities Company, a subsidiary. The railway company is negotiating for the purchase of the municipal electric plant at Laurel.

CLARKSBURG, W. VA.—The Clarksburg Gas & Electric Company is negotiating with the Council for the installation of an electric lighting system in the Glen Elk section.

COLLINSDALE, W. VA.—The Paint Creek Mining Company plans to rebuild its power house and tipple, recently destroyed by fire.

GRAFTON, W. VA.—Plans are being prepared for the installation of a street-lighting system on Main Street.

LOGAN, W. VA.—Contract has been awarded by the Kentucky & West Virginia Power Company to the Foundation Company, New York City, for an addition to its power plant. A steel-tower transmission line will be erected from Logan to Hazard, Ky., 125 miles long. The cost of the work is estimated at about $800,000.

HARRISONBURG, VA.—Plans are considered for the installation of another 500-hp. unit at the municipal auxiliary steam-operated electric plant now in course of construction.

NORFOLK, VA.—The Virginian Railway is considering plans for the electrification of 16 miles of mountain roads, to cost about $500,000.

WINCHESTER, VA.—The Northern Virginia Power Company has petitioned the State Highway Commission for permission to extend its transmission lines along the Shenandoah Valley turnpike from Stephens City to Strasburg.

North Central States

DETROIT, MICH.—Plans for a new group of buildings to be erected by the board of directors of the Sacred Heart Seminary, 1219 Washington Boulevard, provide for a two-story power house, 64 ft. x 147 ft. The cost of the entire work is estimated at $500,000.

DETROIT, MICH.—The Public Lighting Commission is preparing plans for the erection of a municipal power plant at Morrell Street and the Detroit River and for a substation in this section. Smith, Hinchman & Grylls, 800 Marquette Building, are architects.

CLEVELAND, OHIO. — Arrangements have been made whereby the Cleveland Electric Illuminating Company will supply the Northern Ohio Traction & Light Company, Akron, with additional energy to be distributed in Akron and nearby towns. Provision is also made for an interchange of power. The project will involve an expenditure of about $700,000 and will include the erection of a high-tension transmission line to connect the two cities. The Cleveland company will erect the line to the Cuyahoga County line and the Northern Ohio company from this point to its plant in South Akron. An additional transformer station will be erected at the Akron plant. Additional generating equipment will be installed at the Cleveland plant, increasing the output from 208,000 kw. to 263,000 kw. The system when complete will connect Cleveland with Toledo on the west, Pittsburgh on the east and Mansfield, Zanesville and Bridgeport on the south.

MAYSVILLE, KY.—The Maysville Public Service Company contemplates extensions and improvements to its plant and system.

INDIANAPOLIS, IND.—Plans are under way for the construction of a central power house for service at the James Whitcomb Riley Hospital, Indiana University of Medicine and the Robert W. Long Hospital, to cost about $275,000. The State Executive Committee is in charge.

SULLIVAN, IND.—The Vigo Mining Company, Ross Dispensary Building, Terre Haute, contemplates the erection of a power plant here, to cost about $75,000. The Shourds-Stoner Company, Tribune Building, Terre Haute, are architects.

BLOOMINGTON, ILL.—The installation of an ornamental lighting system on South Main Street from Mill Street to Highland Park is under consideration.

ELBURN, ILL.—Extension will be made to the municipal power plant, to cost about $25,000. Alford, Burdick & Housch, 8 South Dearborn Street, Chicago, are engineers.

EVANSTON, ILL.—Steps have been taken by the merchants on Davis Street to install an ornamental lighting system on that thoroughfare.

FREEPORT, ILL.—Plans are being prepared by the Arcade Manufacturing Company for a new power house and woodshop and plant alterations, to cost about $60,000.

GILLESPIE, ILL.—Arrangements are being made by the Southern Illinois Light & Power Company for extensive improvements to its local system.

McLEANSBORO, ILL.—Plans are being prepared for construction of water-works system, including an impounding reservoir, filter plant, several miles of pipe line, new engines and generators. W. A. Fuller, Railway Exchange Building, St. Louis, is engineer.

FORT ATKINSON, WIS.—The Fort Atkinson Canning Company is planning to build a new canning factory, including power plant and other buildings, to cost about $100,000. Bids, it is understood, have been asked for the work.

JANESVILLE, WIS.—The Board of Public Works has awarded a contract to the Janesville Electric Company for the installation of ornamental street lamps on South Main and South Jackson Streets.

MANITOWOC, WIS.—Plans are under consideration by the Wisconsin Public Service Corporation for the rearrangement of its lines to enable it to improve its lighting and power service in towns of Manitowoc and Calumet Counties. The proposed plans include the establishment of a substation at Valders and extensions of its line to Collins to furnish service there; also the erection of a new transmission line between Manitowoc and Chilton.

MILWAUKEE, WIS.—Extensions to the street-lighting system, to cost about $100,000, are under consideration. G. Staal is city engineer.

OSHKOSH, WIS.—The Badger Lumber & Manufacturing Company has started work on a new plant to replace the factory and power house recently destroyed by fire. The plant will cost about $150,000 and will be equipped throughout with motor-driven machinery.

ADA, MINN.—Bonds to the amount of $28,000 have been voted for the installation of a new electric distribution system.

SIOUX CITY, IOWA.—The installation of a new street-lighting system in the downtown district is under consideration. L. Hintgen is city engineer.

PARIS, MO.—Extensions and improvements will be made in the municipal power house and a city-owned ice manufacturing plant established. W. B. Rollins & Company, 521 Railway Exchange Building, Kansas City, are architects.

ST. LOUIS, MO.—The Light & Development Company of St. Louis has purchased a site of about fourteen acres in the Columbia bottoms adjacent to the Mississippi River in North St. Louis as a tentative location for a power house to be operated in conjunction with and supplementary to the power plant of the Cupples Station Light, Heat & Power Company, a subsidiary of the former company.

BROCK, NEB.—Bonds to the amount of $6,500 have been voted for the purpose of securing electricity from the Nebraska City Utilities Company.

CHESTER, NEB.—Bids will be received by the village clerk until Feb. 7 for changing the system of the municipal electric plant from direct to alternating current. The Prince-Nixon Engineering Company, Peters Trust Building, Omaha, is engineer.

LINCOLN, NEB.—The Lincoln City Hospital Association, it is reported, is receiving bids for the construction of a hospital and power house at Seventeenth and Sewel Streets. Davis & Wilson, Security Building, are architects. J. L. Teeters, 1812 D Street, is chairman of association.

BALDWIN, KAN.—The installation of an improved street-lighting system is under consideration by local business men.

EMPORIA, KAN.—The Kansas Electric Power Company will make extensions and improvements to its generating plant, including the installation of additional equipment. Horner & Wyatt, 306 McMillen Building, Kansas City, Mo., are engineers.

PITTSBURG, KAN.—Bids will be received by Leonard Boyd, city clerk, until Feb. 7 for an electrically operated pumping plant to be used in connection with new sewage-disposal works. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

PRATT, KAN.—The installation of a new boiler in the municipal electric plant is under consideration.

Southern States

RALEIGH, N. C.—The Yadkin River Power Company has issued $4,000,000 in bonds, part of the proceeds to be used for the purchase of the property of the Palmetto Power & Light Company and for proposed extensions and improvements.

WHITEVILLE, N. C.—Bids will be received by the Council until Feb. 9 for equipment for the municipal electric plant, to include one 90-kva. and two 150-kva. generators, direct-connected to "uniflow" engine; three-panel switchboard, exciter and auxiliary equipment; also, at the same time, for alternate estimates for Diesel engines. J. B. McCrary, Atlanta, Ga., is engineer.

CLEVELAND, GA.—O. C. Bell is organizing a company to construct and operate a local power plant for commercial service. Robert & Company, Atlanta, are engineers.

FORT LAUDERDALE, FLA.—The Carmichael Development Company plans to install an electric system for commercial street-lighting service on a 700-acre tract now being developed for residential purposes.

CHATTANOOGA, TENN. — The Casey-Hedges Company will install electric power equipment at its new boiler and tank manufacturing plant, to cost about $200,000.

RICHARD CITY, TENN. — The Dixie Portland Cement Company, Chattanooga, will install motors and other electric power equipment in connection with extensions and improvements, to cost $250,000.

CHILDERSBURG, ALA.—The Alabama Power Company has been granted a franchise to install a distributing system here.

RUSSELLVILLE, ALA. — Bonds to the amount of $24,000 have been issued for extensions and improvements to the municipal light and water plant.

SHEFFIELD, ALA.—Plans for the proposed new local cement manufacturing plant to be built by a company now being organized by Samuel W. Kendall, Meridian, Miss., include a power plant. The cost is estimated at $1,000,000.

WIGGINS, MISS.—The Finkbine Lumber Company contemplates the construction of a power house in connection with rebuilding its lumber plant, recently destroyed by fire, causing a loss of about $500,000.

ARKADELPHIA, ARK.—The Arkansas Power Company is making arrangements for an issue of $500,000 in bonds for extensions and improvements.

EL DORADO, ARK. — The Arkansas Light & Power Company has started work on the erection of a high-tension transmission line to Smackover, to cost about $95,000.

EL DORADO, ARK.—The Evans-Thwing Refining Company, 624 Finance Building, Kansas City, Mo., will install electric power equipment at its proposed local oil-refining plant, to cost about $500,000.

KETCHUM, OKLA.—The Grand River Hydro-Electric Power Company contemplates the construction of a hydro-electric plant on the Grand River, with initial capacity of about 17,000 hp.

ABILENE, TEX.—Plans are being considered by the West Texas Utilities Com-

pany for extensions to its main power station and system.

CLARKSVILLE, TEX. — Electrically operated machinery and other equipment will be installed in connection with extensions to the municipal waterworks system.

SAN ANTONIO, TEX.—The Valley Electric Company, recently organized, will take over the plants at McAllen, San Juan, Alamo, Donna and Mercedes. The company is a subsidiary of the Central Texas Company.

Pacific and Mountain States

MANSON, WASH. — The Washington Water Power Company will install and operate a distributing system here. Power will be secured from the proposed transmission line to Lake Chelan.

RIVERSIDE, WASH. — The Riverside Irrigation District, which plans to establish an irrigation project covering 4,000 acres of land, has authorized an issue of $450,000 in bonds. A hydro-electric plant will be built on the Okanogan River at McLaughlin Canyon to furnish power to operate the pumping system. N. Aall, Riverside, is engineer.

SEATTLE, WASH. — Bids will be received by the Board of Public Works until Feb. 9 for electrical equipment for the North substation of the municipal Skagit River development.

TACOMA, WASH.—The Puget Sound Power & Light Company has been granted a franchise to erect and operate electric transmission lines in a large district in Pierce County, including Puyallup.

FRESNO, CAL.—The San Joaquin Light & Power Corporation will erect a substation at Orange and California Avenues, to cost about $102,000, to replace an existing plant. Plans are being prepared for the construction of a hydro-electric plant on the Kings River and a 22-mile transmission line to the site from Piedra, to cost about $175,000.

HUNTINGTON, CAL.—The installation of an ornamental lighting system on Ocean Boulevard, a distance of 3 miles, is under consideration by the Board of City Trustees.

LONG BEACH, CAL.—The Southern California Edison Company contemplates the erection of a transformer station at the intersection of Pine and Locust Streets, to cost about $250,000.

LOS ANGELES, CAL. — The Southern Pacific Railroad Company, San Francisco, will build a power plant in connection with its new shops and terminal on the San Fernando Road, to cost about $1,000,000.

OAKLAND, CAL.—Bids will be received by George B. McDougall, chief of division of architecture, Forum Building, Sacramento, until Feb. 15 for consfruction of an employees' cottage, women's shop building, power house and recreation building for the Industrial Home for Adult Blind, Oakland.

SAN FRANCISCO, CAL.—Electric power equipment and a substation will be installed at the plant to be erected at South San Francisco by the Metal & Thermit Corporation, 120 Broadway, New York, and Swift Street, San Francisco, to cost about $1,500,000.

SANTA ANA, CAL. — Plans are being prepared for the installation of a fire-alarm system.

ADAIR, IDAHO.—The Smith River Light & Power Company, recently organized, is planning to erect a power plant on the Smith River. The proposed plant will be driven by Diesel engines. C. Romander is general manager.

TOMBSTONE, ARIZ. — The installation of a municipal electric plant is under consideration.

Canada

GRAND FALLS, N. B.—The International Paper Company, 30 Broad Street, New York, contemplates the construction of a hydro-electric plant in connection with a new local paper mill, to cost about $500,000.

BRIDGEBURG, ONT.—The installation of an electric light and power system in Bridgeburg, to cost about $50,000, is under consideration. It is proposed to secure energy from the Hydro-Electric system at Stevensville, 8 miles distant.

NORTH BAY, ONT.—The French River Power and Development Association has been organized in connection with a proposition to develop the power resources of French River. D. Barker, North Bay, is chairman.

ORILLIA, ONT.—The Water, Light and Power Commission contemplates extending the municipal electric lighting system to Victoria Point and Grape Island.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 9, 1923)

1,441,640. SHUNT CONNECTION; R. B. Taylor, Cleveland, Ohio. App. filed March 28, 1922. Connecting shunts or cables to the brushes of electric machines.

1,441,685. ELECTRIC ARC SOLDERING; E. H. Jones, London, England. App. filed Sept. 18, 1918. Electrode covered with suitable material to prevent excessive oxidation.

1,441,686. METAL ELECTRODE USED IN DEPOSITING AND SOLDERING BY THE ELECTRIC ARC; E. H. Jones, London, England. App. filed Sept. 18, 1918. Base-metal electrode covered with nickel or other suitable coating.

1,441,687. ELECTRIC ARC SOLDERING; E. H. Jones, London, England. App. filed July 16, 1919. Electrode of base material covered with carbon.

1,441,688. ELECTRODE AND WELDING AND LIKE ROD USED IN SOLDERING AND DEPOSITING METALS; E. H. Jones, London, England. App. filed Feb. 18, 1920. Formed of rods of different materials.

1,441,755. TROLLEY-WHEEL MOUNT; T. Sanders, Kingman, Ind. App. filed July 5, 1922.

1,441,791. TELEPHONE SYSTEM; H. M. Friendly, Portland, Ore. App. filed June 11, 1917. Enables party calling from a central exchange telephone to obtain access over a trunk line to stations in a private automatic exchange.

1,441,792. ELECTRIC ACCUMULATOR; W. O. Garbutt, Gloucester, England. App. filed June 19, 1922. Method of desulphating battery plates.

1,441,801. TERMINAL; F. G. Guenther and W. C. Grabau, Seattle, Wash. App. filed Dec. 6, 1920. Moisture-proof housing for covering connection between battery and cable.

1,441,822. FLASHLIGHT; E. R. Barany, New York, and W. S. Pritchard, Mount Vernon, N. Y. App. filed Sept. 14, 1921. Light beam carefully focused.

1,441,872. AUDIBLE SIGNAL DEVICE OF THE VIBRATORY DIAPHRAGM TYPE; J. F. Monnot and E. T. Cook, London, England. App. filed June 24, 1919. Operated by racket and motor.

1,441,877. DIRECTION SIGNAL; P. W. Padden and O. C. Reynolds, Maumee, Ohio. App. filed Nov. 5, 1920. For automobiles.

1,441,883. FLASHLIGHT; J. T. Roffy, Brooklyn, N. Y. App. filed Jan. 2, 1920. Guard around lens to prevent breakage.

1,441,884. FLASHLIGHT; J. T. Roffy, Brooklyn, N. Y. App. filed Jan. 3, 1920. General diffused illumination.

1,441,902. INTERMITTENT ELECTRIC LIGHT FLASHER; E. M. Bailey, Albion, Ill. App. filed July 10, 1920. Operated by pendulum of clock.

1,441,988. WIRELESS-WAVE DETECTOR; E. P. Lindner, Indianapolis, Ind. App. filed Dec. 18, 1920. Carborundum detector.

1,442,013. LAMP RECEPTACLE; G. B. Thomas, Bridgeport, Conn. App. filed June 3, 1918. Cleat receptacles.

1,442,027. CHAIR FOR X-RAY WORK; R. Levenson, New York, N. Y. App. filed July 28, 1921. Means for accurate positioning and supporting of patient's head.

1,442,031. METHOD OF SUSPENDING ELECTRODES; C. E. Söderberg, Christiania, Norway. App. filed Jan. 27, 1920. Electrodes baked in furnace in which they are used.

1,442,033. METHOD OF OPERATING ELECTRIC FURNACES; M. O. Sem and Einar Lund, Christiania, Norway. App. filed Oct. 22, 1921. Charging fuel to furnace through hollow electrode.

(Issued Jan. 16, 1923)

1,442,041. GRINDER REGULATION SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Sept. 11, 1920. Control of hydraulic pressure employed to force material into pulp grinder.

1,442,042. GRINDER REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Sept. 11, 1920. Load-control apparatus for pulp grinders.

1,442,048. ELECTRIC WATER HEATING APPARATUS; H. W. Christian, Detroit, Mich. App. filed Aug. 25, 1921. Thermostatic mechanism regulates temperature of water.

1,442,050. ELECTRIC REGULATION; J. L. Creveling, White Plains, N. Y. App. filed March 7, 1917. Voltage regulator for generators.

1,442,053. CONTROL SYSTEM; R. E. De Camp, Wilkinsburg, Pa. App. filed May 12, 1919. Motor-starting resistance automatically cut out.

1,442,064. REMOTE CONTROL FOR INDICATORS; O. E. Groshall, Salt Lake City, Utah. App. filed Jan. 21, 1920. Auxiliary cash-register indicators.

1,442,082. PARTY-LINE TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed July 20, 1905. Complete automatic system.

1,442,085. MAXIMUM-DEMAND METER; W. G. Mylius, Wilkinsburg, Pa. App. filed May 13, 1918. Integrated periodic demand.

1,442,086. AUTOMATIC TELEPHONE SYSTEM; F. Newforth, Jr., Norwood, Ohio. App. filed Sept. 18, 1914. Measured-service reverse-battery telephone system.

1,442,109. ELECTRIC RANGE; A. W. Walker, Malden, Mass. App. filed June 2, 1921. Current carrying and controlling apparatus readily accessible.

1,442,130. TELEPHONE SYSTEM; H. D. Currier, Chicago, Ill. App. filed July 18, 1918. Filters out all low-frequency currents.

1,442,131. ELECTROMAGNETIC GOVERNOR; C. W. Dake, Chicago, Ill. App. filed Aug. 20, 1919. Governor for turbo-generator sets.

1,442,146. MODULATING AND TRANSMITTING SYSTEM; R. A. Heising, East Orange, N. J. App. filed April 13, 1918. Radio-sending apparatus.

1,442,147. PRODUCTION OF MODULATED FREQUENCY OSCILLATIONS; R. A. Heising, East Orange, N. J. App. filed Nov. 17, 1916. Methods for producing modulated high-frequency oscillations.

1,442,202. ELECTRICAL SYSTEM; R. J. Wensley, Edgewood Park, Pa. App. filed March 14, 1918. Automatic starting and stopping of rotary converter.

1,442,238. ELECTROLYTIC APPARATUS; A. K. Smith, Cleveland, Ohio. App. filed July 29, 1922. Overvoltage prevented by coating electrodes with a nickel oxide.

1,442,243. PROCESS FOR CLEANING SCALE FROM METALS; G. A. Avery and F. Bamblett, Detroit, Mich. App. filed March 23, 1922. Material subjected to current in solution of mineral acid.

1,442,273. TROLLEY; W. T. Hill, York Harbor, Me. App. filed June 15, 1922. Wheel attachment to prevent contact from leaving wire.

1,442,284. ELECTRIC CONNECTOR; J. A. McKay, New York, N. Y. App. filed Feb. 21, 1920. Several types of plugs may be used with outlet box.

1,442,288. ELECTRIC SIGNALING SYSTEM; W. C. Neahr, Denver, Col. App. filed Dec. 17, 1918. Semaphore for railroad crossings.

1,442,310. TIME-LIMIT, CURRENT-LIMIT CONTROL FOR ELECTRIC MOTORS; L. W. Thompson, Schenectady, N. Y. App. filed Aug. 11, 1920. Starting and stopping control for motors.

1,442,320. SYSTEM OF ELECTRICAL DISTRIBUTION; E. Beuer and W. A. Turbayne, Niagara Falls, N. Y. App. filed Sept. 14, 1917. Voltage regulator for variable-speed generator for charging batteries.

1,442,425. TELEPHONE-REPEATER SYSTEM; R. D. Conway, Chatham, N. J. App. filed Dec. 27, 1918. Methods for automatically selecting and associating balancing networks with a repeater.

1,442,427. ANTI-SIDE-TONE SUBSTATION CIRCUIT; G. D. Edwards, East Orange, N. J. App. filed Aug. 6, 1919. Circuit specially adapted for train dispatcher's telephone.

1,442,429. IMPULSE-TRANSMITTING MECHANISM; J. B. Harlow, Upper Montclair, N. J. App. filed July 14, 1917. Transmitting mechanism provided with indicator showing operator condition of distant signal.

1,442,430. ELECTRON-DISCHARGE DEVICE; R. V. L. Hartley, East Orange, N. J. App. filed Dec. 31, 1919. Filament and plate energized from same machine in which any variations are automatically neutralized.

1,442,437. PROCESS OF GALVANIZING WHEEL RIMS; L. V. Mather, Detroit, Mich. App. filed Nov. 12, 1920. Mechanical cleaning of metal used instead of pickling process.

1,442,438. ELECTROPLATING APPARATUS; L. V. Mather, Detroit, Mich. App. filed Feb. 6, 1922. Articles progressively advanced through electrolytic bath.

1,442,439. VACUUM REPEATER; R. C. Mathes, New York, N. Y. App. filed Nov. 4, 1916. Minimizing variations of plate circuit due to supply voltage.

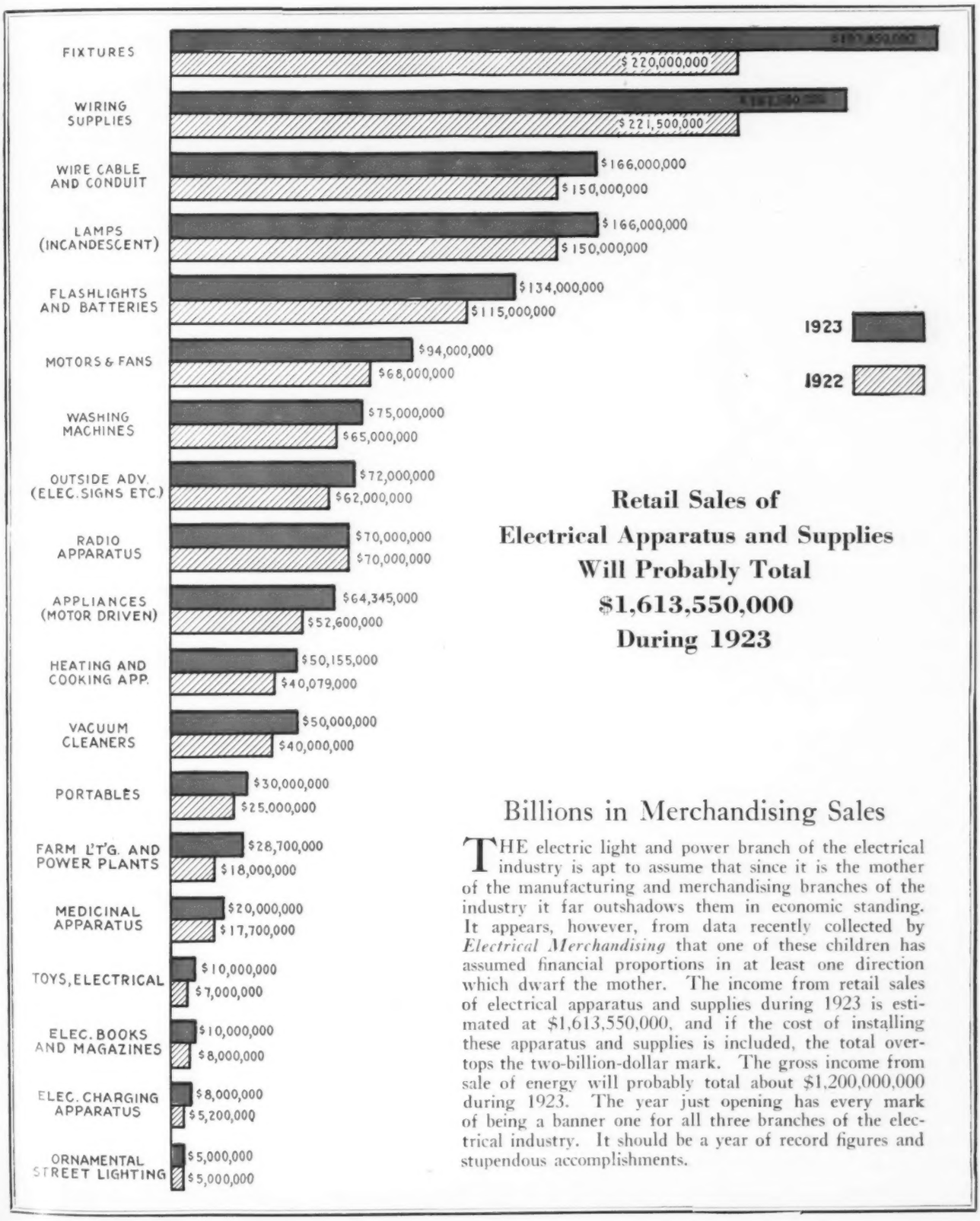
1,442,455. TRANSMISSION MEASURING CIRCUITS AND METHOD; D. F. Whiting, New York, N. Y. App. filed Oct. 22, 1919. Measurement of repeater gains in telephone circuits.

1,442,456. MOUNTING AND PROTECTING ELECTRICAL APPARATUS; D. F. Whiting, New York, N. Y. App. filed June 1, 1920. Mounting of telephone repeater equipment on panelboards.

1,442,460. CURRENT-CONTROLLING MEANS FOR ELECTRIC CIRCUITS; G. A. Anderegg, Oak Park, Ill. App. filed June 30, 1917. Reactor for transmission lines.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

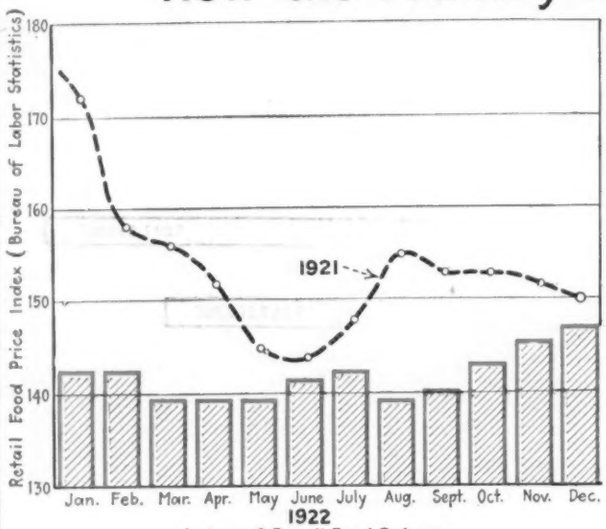


Retail Sales of Electrical Apparatus and Supplies Will Probably Total $1,613,550,000 During 1923

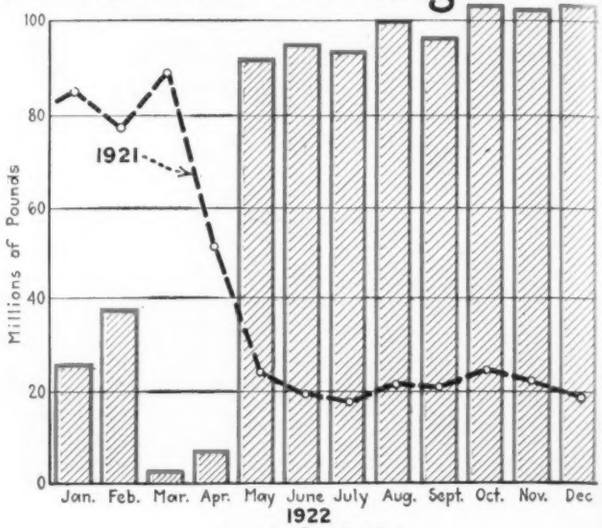
Billions in Merchandising Sales

THE electric light and power branch of the electrical industry is apt to assume that since it is the mother of the manufacturing and merchandising branches of the industry it far outshadows them in economic standing. It appears, however, from data recently collected by *Electrical Merchandising* that one of these children has assumed financial proportions in at least one direction which dwarf the mother. The income from retail sales of electrical apparatus and supplies during 1923 is estimated at $1,613,550,000, and if the cost of installing these apparatus and supplies is included, the total overtops the two-billion-dollar mark. The gross income from sale of energy will probably total about $1,200,000,000 during 1923. The year just opening has every mark of being a banner one for all three branches of the electrical industry. It should be a year of record figures and stupendous accomplishments.

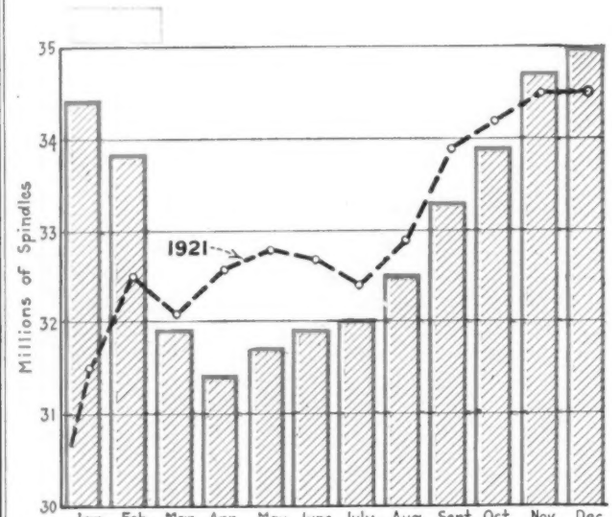
How the Primary Industries are Trending



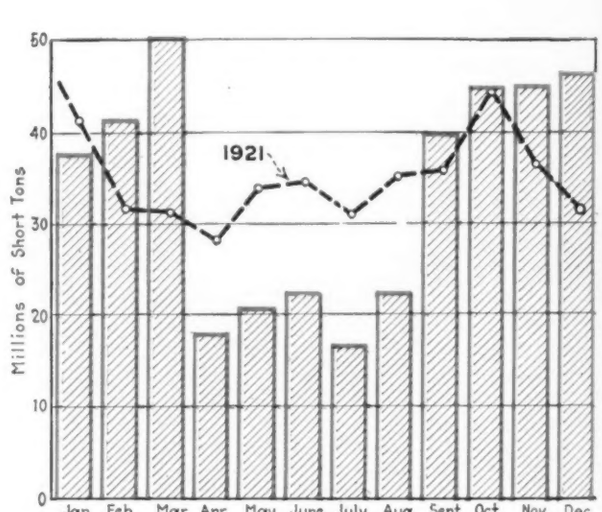
Index of Retail Food Prices



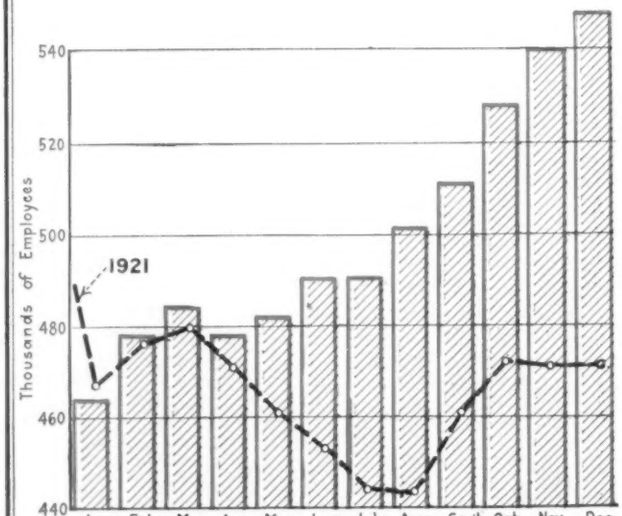
Copper Production



Activity of Spindles in Cotton Mills



Bituminous Coal Production



Employees in Factories of New York State

The Coal Shortage Disappears

MOST gratifying are the data which have been issued by the Department of Commerce on the production of bituminous coal for the year 1922. These data indicate that, despite the five months' strike, bituminous-coal production was only 11,000,000 tons, or less than 3 per cent, below the tonnage mined during 1921. In December, notwithstanding the fact of the holiday season, the production was the greatest since March and was 50 per cent above the amount taken from the mines in December, 1921. Such favorable activities taken in conjunction with the recent agreement entered into by the operators and miners point to a year free from fuel shortage troubles, and it is to be hoped that this condition will be reflected in a material reduction in the price of coal to the consumer.

Copper production was maintained during December, being 458 per cent greater than the production reported for December, 1921.